

the **RACV**
ENERGY
breakthrough

SCHOOLS' HANDBOOK

20 years
in the making

MARYBOROUGH, VICTORIA

NOVEMBER
18-21 2010

□ www.racvenergybreakthrough.net
www.racvenergybreakthrough.net



HOLDEN

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*See
the
site
for
late
breaking
news!*

www.racvenenergybreakthrough.net

The RACV ENERGY BREAKTHROUGH has been a sensational success since 1991 providing opportunities for students and members of the community to expand their knowledge and understanding of technology as it affects the way we live and learn.

Your school can be part of it.

This Handbook is designed to answer all your questions. It contains information about:

- ☐ how your school can become involved in the Energy Breakthrough
- ☐ how your school can enter
- ☐ what you need to do to develop an entry
- ☐ what sort of entries you can prepare
- ☐ what happens at Maryborough
- ☐ how your entries will be assessed
- ☐ design specifications and trial regulations.

The RACV ENERGY BREAKTHROUGH is jointly managed by the Victorian Department of Education and Training, the Country Education Project, Central Goldfields Shire Council – Maryborough and proudly sponsored by the RACV.

Program Sponsors



Welcome to the 2010 RACV ENERGY BREAKTHROUGH

It's more than an event, it's a new way of thinking

"I drive a Porsche 928. Enjoy it tremendously. But I can see huge changes coming, with growing awareness of social and environmental responsibilities. We can't keep on having inefficient cars. I don't believe the world can go on consuming fuel recklessly. Wasting fuel. Not just because of diminishing reserves but what it is doing to the planet. Spewing out pollution. Vehicles have to be far more sensible in payload, much lighter, retain passenger comfort because you do need that, and be much safer.

It needs another breakthrough ..."

- Ralph Sarich: Wheels Magazine, February 1991

The RACV ENERGY BREAKTHROUGH, is without doubt, one of the most exciting and important events in the Victorian Education calendar and among the finest student participation events in the world. Developed by the Country Education Project, the Breakthrough offers male and female students, in both city and country schools, exciting real world challenges in science, technology and environmental education, with a particular focus on transport.

It's more than an event, it's a new way of learning

The RACV Energy Breakthrough adds new dimensions to curriculum planning for thousands of teachers. The event's focus on energy and innovation enables teachers to involve primary and secondary students in exciting, 'hands on' learning experiences throughout the year.

The objective of designing and constructing a vehicle, a machine or an innovation in technology, encourages a team effort and provides rich material for an integrated curriculum approach. As teachers have told us ...

'This is the greatest educational experience for students I have ever had the privilege to participate in.'

'It brings the classroom into the real world.'

'It's a fabulous concept that provides a real purpose to learn about a great range of curriculum area: maths, science, language, health and human relations.'

More than an event, it's a passport to a sustainable future.

The **RACV Energy Breakthrough** can also bring **community** and school together. It provides opportunities for students, teachers, parents, local industry and other groups to work together.

While having fun and achieving goals, students examine and use the latest **technology** to explore how we can reduce impact on the **environment** by changing the way we live and get around. As teachers have told us ...

'A wonderful real life experience with all the pressures of dealing with the unexpected, meeting deadlines and developing procedures and strategies.'

'It is a great project that provides a great "vehicle" for getting kids involved in their learning.'

More than an event, it's a new way of having fun.

The 2010 RACV Energy Breakthrough comes together in Maryborough from the 18th. to the 21st. November, 2010 as a celebration of the year's work by the students who buzz with the excitement of demonstrating their achievements, talking about their experiences and testing their vehicles in rigorous trials.

Beautiful Maryborough throws itself open to this celebration of young people and their learning. The green Grand Prix's Lakeside circuit nestles adjacent to Princes Park which is alive with Innovations in Technology and an Energy Expo. As teachers have told us ...

'You cannot come away from the three days in Maryborough with anything but a glow about the value of this project for those students involved.'

'The experience for the children and the whole school community was extremely beneficial and enjoyed by all involved.'

So there you go in the meantime ...

**All the best to the whole Breakthrough community from
The RACV Energy Breakthrough Planning Committee.**



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All changes and Additions to rules and Specifications for 2010 have been underlined throughout this Handbook.

Part A

Everything You Ever Wanted To Know



1. What is the Energy Breakthrough?



The RACV ENERGY BREAKTHROUGH is an exciting program designed to provide opportunities for students, teachers, parents and local industry to work together to design and construct a vehicle, a machine or innovation in technology that will represent an energy breakthrough.

The program encourages participants to examine and use the latest technology while considering its impact on the environment and the way people live locally and globally. The RACV Energy Breakthrough isn't just a once-a-year event!

School groups work throughout the year to design, build and test vehicles or machines within detailed specifications. It requires a team effort and an across-the-curriculum approach. These groups then bring their vehicles and machines to Maryborough in November, for a huge celebration in which they can demonstrate and trial them in action.

Aims

THE RACV ENERGY BREAKTHROUGH aims to:

- actively involve young people in finding solutions for a world they will inherit
- provide an excellent technology studies project for primary and post-primary students
- provide a great opportunity for schools and communities to work and learn together
- provide an opportunity for women and girls to participate in what has traditionally been a 'male' area of the curriculum
- be a fun program with real world challenges
- offer students opportunities to explore and address vehicle design, driving skills and vehicle and passenger safety issues.

2. Where and when is it Held?

Dates & Location

Participants in THE 2010 RACV ENERGY BREAKTHROUGH will gather in Maryborough, Victoria from Thursday, November 18th to Sunday, November 21st to celebrate their achievements. Activities will include:

- judging of the design and construction
- judging of display and presentation
- on track elements.

Maryborough comes alive during this time with a host of great things to see and do. The Sustainable Energy Expo presents an excellent backdrop to THE 2009 RACV ENERGY BREAKTHROUGH. It is appropriate that the event is called the Energy Breakthrough because with so much to do, energy is the one thing you must bring when you come to Maryborough. As always - **the theme is energy.**

Accommodation & Camping

Your entry fee to the 2010 RACV ENERGY BREAKTHROUGH will cover camp site fees for your team. You will be directed to your campsite by a camping co-ordinator upon arrival.

You will need to provide:

- **your own camping equipment**
- **your own food.**

The camping areas are spread throughout the precinct on grassed areas. Some sites are inside the race circuits, whilst others are adjacent to Lake Victoria and the Maryborough Swimming Pool. Facilities provided include:

- Toilets
- Showers
- Water
- Power (for lighting only). All electrical leads must be 'tested and tagged'.

Teams may stay overnight on the Sunday after the event to ensure that the team travels home safely on the Monday.

Please familiarize yourself and all team members and support crew with the precinct map on page 70. There is ample camping available within the RACV Energy Breakthrough site, in the following areas:

- **Princess Park Oval** Primary Schools only
[No caravans or campervans will be permitted on Princes Park Oval](#)
- **Jubilee Oval** Secondary Schools only
- **Hockey Field** Hybrid Teams only
- **Maryborough Caravan Park** (by prior arrangement). Primary Schools

PLEASE NOTE: Primary schools who require caravans or camper vans will need to make arrangements at the caravan park. Primary Schools wishing to camp in the Maryborough Caravan Park must make their own booking arrangements Ph: 03 5460 4848. Only 10 students and two adults per team will be covered by the RACV ENERGY BREAKTHROUGH entry fee for three (3) nights. Additional campers must be paid for directly to the Maryborough Caravan Park.

The RACV Energy Breakthrough site is alcohol free.

3. Who Can Enter?

Teams

- All entries are to be team entries and must consist of current school students
- Teams in the **Human Powered Vehicle, Hybrid** and **Try-athlon** categories will consist of a minimum of six and a maximum of eight riders (except for Hybrid two-seaters where the maximum number of riders is 12), of whom at least half must be female
- Teams in the **Pushcart** category will consist of a minimum of eight and a maximum of ten participants, of whom at least half must be female.
- **Innovations in Technology** teams must have a minimum of four and maximum of six, at least half of whom must be female.
- All team members must be familiar with the operation of their vehicle, innovation or pushcart and must participate equally in the on track Trials at Maryborough.
- Team members do not have to all come from the same school. They could be part of a scout, church, or other community group, however they must still all be current school students and be covered by the group's insurance.

Categories & Classes

Category	Classes	Quotas
Human Powered Vehicles	Class A1: <i>Primary students from schools with enrolment of 200 or less</i> Class A2: <i>Primary students from schools with enrolment more than 200.</i>	70
	Class B1: <i>Students from Years 7 and 8</i> Class B2: <i>Students from Years 9 and 10</i>	80 <i>(inc. max of 20 entries in Open)</i>
	Class C: <i>Students from Years 11 and 12</i>	
	Open: <i>Open entries are for any group of school students that cannot fulfill the gender requirements set out above (see note below).</i>	
	All Female B/C: <i>Teams consisting of all girls Years 7 - 12.</i>	10
Try-Athlon	Class A, B/C and Open: <i>as per HPV Classes</i>	40
Hybrid	Class 1 (B/C), Class 1 (Open), Class 2 (Open) <i>– Gender requirements per HPV classes.</i>	40
Pushcarts	Section 1 (PC1): <i>Teams from schools with enrolment of 150 or less.</i> Section 2 (PC2): <i>Teams from schools with enrolment more than 150.</i>	70
Innovations In Technology	<i>Open to Primary & Secondary students.</i>	40

- **Quotas will be filled on a 'first come' basis.**
- A maximum of three entries per school in the HPV and Pushcart categories will be accepted.
- Additional entries from a school will be placed on a **waiting list** and will be notified when accepted into the event.

HPV & Try-athlon Open Class entries have the following conditions:

- A maximum of 20 entries will be accepted in the HPV Open category
- Teams registered in the HPV B or C class or [the Try-athlon A or B/C class](#) and requesting a transfer to HPV [or Try-athlon Open](#) will incur a 50 (HPV) or [15 \(Try-athlon\)](#) lap penalty in the trial.
- Only one entry per school will be accepted in the HPV Open Class. Schools that have a team in the HPV Open Class will not be able to add further teams to this class.
- **Primary schools** may only enter one team in the Try-Athlon Open category.

4. What are the Categories of Entry?

The 2010 RACV ENERGY BREAKTHROUGH has five separate categories designed to cater for different levels of technology application and understanding:

- **Innovations in Technology**
- **Pushcarts**
- **Human Powered Vehicles**
- **Hybrid Powered People Carriers**
- **Try-athlon**

Innovations in Technology

Proudly sponsored by Central Highlands Water

The challenge for Innovations in Technology is **WORKING WITH WATER**. Central Highlands Water is the major sponsor of this section and they have an interest in water and its use.

Challenge 1: Crafty Design

Open to Primary & Secondary Students



The challenge for **Crafty Design** is to create a craft that resembles some of the Macro invertebrates that live in and around the water. Using construction materials such as TEKOL, LASY and LEGO in conjunction with scrap material, create a stable craft (in keeping with the Theme) which will run under its own power, along a channel of 9.4 metres x 81.5 cm, carrying a full soft drink can. Please note the water depth of the channel is approximately 12 centimetres. Craft must complete one full length of the channel.

The fuel source must be an alternative to fossil fuel. Dry cell batteries and/or capacitors are **NOT** permitted.

Challenge 2: Moving Water Wet-N-Wild

Open to Primary & Secondary Students

The challenge for **Moving Water** is for participants to create a water cycle catchment model. This involves building a working scale model which demonstrates, according to certain requirements, how water can be moved from one side of a mountain to another.

- *Craft and Model specifications: see page 34.*

Pushcarts

Proudly presented by the [Country Education Project](#)



This category has been developed for primary schools only. It is a challenging but enjoyable way of introducing energy use and technology to young students. The machines are based on the humble billycart but with a roll bar that may double as a push bar. It is powered solely by students.

Teams of between eight and ten students design and build a pushcart, following a basic plan.

The team may obtain the assistance of other students, parents, friends, local trades people, community groups, etc. The team of up to ten must comprise of at least 50% females and will be required to participate in a range of events on a street circuit at Maryborough in November. These will include an **obstacle** course, **sprint** and **circuit** events. Each team member must participate in at least two of the three track components.

In the Pushcarts category there are two sections:

- **Section 1 (PC1): schools with enrolment less than 150**
- **Section 2 (PC2): schools with enrolment greater than 150.**

For Pushcart Specifications: see page 37.

Human Powered Vehicles (HPVs)



Entrants design, build and compete, using a vehicle powered solely by human power. Design requirements include a maximum length of 2.7 metres, single seat and a minimum of three wheels.

The rules are similar to those for the other Australian HPV events, to allow vehicles from other states to enter. Interstate teams are encouraged to contact the Planning Committee for further information about the event. The School Principal must sign a declaration indicating the level of student involvement in the design and construction and also sign their driver education licence.

Entrants must:

- **Design and build a vehicle 'from a clean sheet'**
- **Develop or adapt a vehicle from an existing design**
- **Liaise with local industry or community groups to design and build a machine.**

All entrants will be required to participate in the Trial sections on the street circuits at Maryborough in November (including a nine-hour lights-on period). There will be a compulsory eight-hour break for primary entrants (Class A) during the night, making the duration of the primary event 14 hours. The HPV B, C, Open and All Female B/C teams participate on the RACV Track and the HPV A event is held on the Holden Track.

Human Powered Vehicle Specifications: see pages 41

Trial Regulations: see page 65.

Hybrid Powered People Carriers



Entrants design, build and compete using a vehicle powered by a combination of at least two energy sources.

Design requirements include a maximum length of 2.7 metres and a choice of single or two-seat configuration. (Dual seat vehicles only may be allowed to exceed the length after consultation with RACV technicians) Size restrictions have been set so that production motor vehicles are not simply modified and entered. For safety reasons, drivers of hybrid vehicles shall be at least 14 years of age, unless special approval is requested by the school and given by organisers.

The Hybrid category will be run in two sections:

- (i) **Pedal Power PLUS one other power source**
- (ii) **Two power sources, excluding PEDAL.**

Entrants must:

- **Design and build a vehicle 'from a clean sheet'**
- **Develop or adapt a vehicle from an existing design**
- **Liaise with local industry or community groups to design and build a machine.**

All entrants will be required to participate in a 24-hour endurance trial (including a nine-hour lights-on period), on a street circuit at Maryborough in November.

Vehicle Specifications: see page 51

Trial Regulations: see page 65.

Try-athlon

Proudly sponsored by Powercor Australia



This is the most widely assessed category at the Energy Breakthrough. Entrants use the same design requirements as for Human Powered Vehicles (HPVs).

All entrants will be required to participate in the Trial sections at Maryborough in November. The trial will consist of three elements:

Time trial, Obstacle course, and Endurance trial.

Vehicle Specifications: as per Human Powered Vehicles

Try-athlon Trial Regulations: see page 72

Try-athlon Open Class has the following conditions:

- Only one entry per **Primary** school will be accepted in the **Try-athlon Open Class**. Primary Schools that have a team in the **Try-athlon Open Class** will not be able to add further teams to this class.
- Teams registered in the Try-athlon A or B/C class and requesting a transfer to HPV or Try-athlon Open will incur a 15 (Try-athlon) lap penalty in the trial.
- In 2011, only one entry per school will be accepted into the Try-athlon Open Class. This rule will apply to both Primary and Secondary school teams.

5. How will our entry be assessed?

All sections must be attempted. Points are awarded in the following sections:

Section	HPV and Hybrid vehicles	Pushcarts	Try-athlon
Design and Construction	25	30	20
Display and Presentation	25	30	20
Trial elements			
• Endurance	50	15	30
• Time Trial		15	15
• Obstacle		10	15

It is the responsibility of each team to ensure they complete all sections. The times for each of these sections are outlined in this Handbook and further details are provided in the Information Kit distributed in November.

Scrutineering

HPV and Hybrid Vehicles will firstly have to undergo a check to ensure the vehicles are **safe** and meet all the **design specifications**. Scrutineers will examine all vehicles before the assessment process starts. Where vehicles do not comply with specifications, or are considered unsafe, scrutineers will provide assistance and/or direction with work required in order to comply.

In 2010, teams will again be allocated hourly blocks in which to complete scrutineering. This will ensure that all vehicles are checked in a timely and efficient manner.

Please Note: Vehicles which do not comply with elements of vehicle specifications, but are considered safe may start the trial with a 50 lap penalty. This penalty can only be applied by RACV Scrutineers.

Design, Construction and Preparation

Following scrutineering, teams will be required to demonstrate to judges that all members have developed a thorough understanding of the design and construction aspects of their entry. Each team will be allocated a time to complete their Scrutineering and Design & Construction. This will be included in the Information Kit to be sent to schools in November. Teams **MUST** complete these assessments within the time allocated.

Purpose

The focus of the Design and Construction is to assess team's understanding of the vehicle and the concepts involved in its design and construction. To this end, teams who have simply purchased a recumbent bicycle (complete or in kit form) and carried out basic modifications, will not score as well as teams who have built a vehicle from scratch. Consideration will be given to teams who have 'Inherited' a vehicle from previous teams but who have improved the design and/or construction in some way.

Design & Construction Format

As part of the Design and Construction assessment, teams will be required to:

- discuss and explain design and construction processes
- show each team member's licence to judges. (*Teams should note the Licence Information and related preparation in Section 12, Track Safety Skills.*)
- show all rider safety equipment to judges including each person's gloves, helmets and goggles.
- show copies of relevant design drawings.

Criteria

The focus for Design and Construction assessment will be:

- **Effort and input** – this is based on issues such as was the vehicle bought, made from new, modified from last year and to what extent the students were involved in the various aspects of design and construction. Teams can show design drawings and models to demonstrate work undertaken by students.
- **Innovation and Quality** – how effective/clever the design concepts are, the materials used, construction methods and types of gears, brakes and steering.
- **Understanding** –the students' understanding of the vehicle design and key design concepts incorporated, the materials, components, running set-up (e.g. tyre pressures etc.)
- **Safety – Design and Understanding** – the use of restraints, roll bars, rider protection and visibility.
- **Practicality, Stability and On-road Performance** – vehicle reliability, lighting, seat adjustments, vehicle handling, etc.
- **Driver Training and Skills Development** – presentation of licences for each team member, skills covered in driver training including driving at night, in the wet, etc.
- **Understanding of Environmental Issues** – the relationship between transport and issues including greenhouse, air pollution and the importance of renewable energy, etc.

Note: Hybrid vehicles will be weighed during Design & Construction assessment to ensure compliance with Vehicle Specification 3.0.



Display and Presentation

Each team will be required to present a 15 minute (minimum) oral report to a panel of judges. This report will relate to the development of the team entry, including ideas that did not work and why. A specific time for each team to complete their Display & Presentation will be included in the Information Kit to be sent to schools in November.

Purpose

The purpose of the Display and Presentation is for the team members to demonstrate their knowledge and understanding of their entry. The Display and Presentation for HPV and Hybrid teams takes place in marquees in the Expo area.

Judges consider the different approaches taken in the presentations, such as some students reading from notes versus student presentations with limited reference to prepared notes. Schools are encouraged to be innovative in their presentations. However, care needs to be taken to ensure that 'distractions' do not overtake the real purpose, that is, *'students demonstrating their understandings'*.

Format

The judging panel consists of three members: a community representative, a young person with an interest in education and/ or technology and an education/teacher representative. Judges will ask questions of team members following their presentation.

Each team is allocated time to set up their display and a half hour time slot for their presentation. All team members are required to participate in the presentation.

The display may include photos, videos, models, prototypes etc should explain the involvement of students, school, community and/or industry in the program and the development of their entry. To reduce interference from nearby panels, no public address or small music (CD) systems will be allowed without prior approval of the Display & Presentation Coordinator.

The presentation should be designed in a way that ensures good information is well presented by students and enables the students to demonstrate their knowledge, understanding and involvement in all aspects of the entry.

Criteria

Judges are asked to look for evidence of:

- Student involvement
- Levels of participation
- Team work and enthusiasm
- Individual contributions
- Understanding of the project.

It is understood that the levels of student involvement in the technical and practical activities related to the design and building of an entry will vary with age.

The oral presentation will be assessed according to:

- **Presentation Style**, including an introduction and outline of the presentation, awareness of the audience, style of presentation (reading from notes or reciting), clarity of language, use of materials, diagrams and models and topics covered.
- **Team Work**, including the effectiveness of leaders role and sharing of knowledge and responsibility in the team, acknowledgment of individual team members role, team attitude and enthusiasm and the extent to which the presentation reflects the students own work.

- **Knowledge and Understanding**, including knowledge of the aims and values of the Energy Breakthrough, highlights of the school and community participation, team planning, preparation and training and technical aspects of the development of the vehicle.

The visual display will be judged according to:

- **Layout and Organisation**, including the range of visual media and written text depicting vehicle development, the arrangement of items, the variety of information presented and the acknowledgment of sponsorship/financial support received.
- **Quality of Display**, including the effective use of diagrams, models, photos, text, drawings, etc. to convey message.
- **Development of a Story** about the entry, including the trials, the preparations, the school and community's involvement and the students' achievements.

Your team's preparation should include some theory and practice in driving a machine on a defined track.



The Trial/s

In this section the operation of each entry will be tested.

- **Secondary Human Powered and Hybrid Powered Vehicles** will complete a 24-hour trial on a street circuit in Maryborough
- **Primary HPV** teams will complete a 14-hour trial on a street circuit in Maryborough
- **Pushcarts** will participate in a 50 metre sprint relay, obstacle course and an endurance relay
- **Innovations in Technology** will undertake a performance test and time trial
- **Try-athlon** teams will complete a time trial, obstacle course and an 8-hour endurance trial.

Refer to the relevant section for each in Part B of this handbook for details.

6. What are the Tracks Like?

The Circuit

There are two tracks in Princes Park, Maryborough surrounding the beautiful Lake Victoria.



The **RACV Track**, shown above, is a challenging 1.3 km street circuit that reflects real-world conditions.

This track will be used for the Secondary HPVs, the Try-athlon Time Trials and Obstacle course and the Pushcart track events.



The **Holden Track**, shown above, is located between the Maryborough Caravan Park and the Princes Park oval. It is approximately 1.1 km long and includes a number of challenging left and right hand bends.

This track will be used by the HPV A (Primary), Hybrid vehicles and the Try-athlon Endurance teams.

On both tracks there are some unlit sections at night, and the sealed surfaces are not billiard table smooth.

The Pit Areas

There will be designated pit areas within walking distance of the camping area (see map). Each team in the HPV, Hybrid and Try-athlon endurance trials will be allocated a site in the pit area.

During the event there will be restricted access to the pit area. All pit sites (approximately 2.8 m by 2 m) are numbered.

All pit sites must be set-up as per the direction of Event Officials. All Teams must leave sufficient clearance area in front of their pit site for rider changeovers and to allow other teams to have line of sight of the track and pit lane.

On the Holden Track pit areas are the same as the vehicle numbers and teams are advised in the Information Kit distributed in early November.

There is no shelter in the Pit areas but there will be space at the rear of each Pit for teams to erect a small tent, or arrange to share a tent with another team. Teams should erect a team or school banner in their designated pit area(s) including team numbers. A banner about two by one metres would be ideal.

PLEASE NOTE: No vehicles or trailers will be allowed in the Try-athlon pit areas.

Lap Timing

Each vehicle will be provided with an electronic transmitter to operate as a Lap Counter. These will be allocated to teams during team registration. It is the team's responsibility to check that their counter is securely fitted and operational at all times during the event. Failure to return the transmitter or damage to the transmitter will result in the school being charged for full replacement costs.

Results: Results Marquees & Wireless

Results Marquees

Laptops displaying current race results are available for viewing in the Results Marquees on each track.

Wireless Network

Live results will be available on-site via a wifi network to any users with a compatible and wireless-enabled laptop.

The required software and details will be provided via the event website prior to the event.



7. How Do We Prepare?

The RACV Energy Breakthrough is an **Education** event that encourages 'learning by doing' and focuses on science, technology and the environment. This is one of the event's key distinguishing features.

Through the RACV Energy Breakthrough, students were given responsibility for their own learning, teachers broke away from the conventional classroom practice and found that it worked, parents were more closely involved in the educational development of their child and community members contributed time, expertise, goods and money.

Deakin University, Evaluation – 1997

Schools undertake the Energy Breakthrough in a variety of ways, ranging from an out of school activity to the RACV Energy Breakthrough being a central part of the formal curriculum. In whatever way the program is undertaken it can contribute to students' learning in a wide range of areas. Feedback collected in 2005 indicated that 16.7% of responding schools completed the project both during class time and after hours, with an equal number exclusively during class (41%) and out of school hours (41%).

Curriculum

Schools have identified the following curriculum areas as having links: technology studies, science, English, arts, environmental science, maths, accounting, computer studies and health and physical education.

The RACV Energy Breakthrough encourages and supports learning that:	
➤	Is Fun and engaging
➤	Is student centred
➤	Involves hands-on activities
➤	Requires active problem solving – on 'real life' issues (authentic)
➤	Is collaborative – builds teamwork skills.
➤	Creates links with the community
➤	Requires students to ACT on their learning
➤	Involves celebration
➤	Values and requires different skills, knowledge , (inter-disciplinary).

Curriculum Resources & Tools

'**Into the Future**' outlines a number of activities designed for upper primary to lower secondary students that can be used to introduce students to the Energy Breakthrough concepts. Available on the RACV Energy Breakthrough web site

Other resources, including **vehicle learning, repair and evaluation exercises; rules investigation assignments and design task proformas** are available on the Energy Breakthrough website in the Curriculum section.

Teachers are encouraged to share resources between schools in order to ease integration into the school curriculum. These can be emailed to: **online@racvenergybreakthrough.net**

Safety, Training and Getting a Licence

There are three elements to Breakthrough preparation:

- **Technology and design of the vehicle**
- **Fitness and endurance**
- **Vehicle handling skills.**

Participants plan and prepare the first two well. Long hours are dedicated to design and construction. Diet and physical training plans sometimes rival Olympic efforts.

However, almost nobody pays attention to training in vehicle handling. MANEUVERABILITY is an extremely important safety issue. Teams will be riding for 24 hours. Well planned training programs may prevent accidents when riders are tired. You have to pedal fast and maintain control, particularly in the face of the unexpected.

Riders need to have some experience and training in the demands of the track. It is essential that students are well prepared for the varied conditions and challenges at the event through pre-event track conditions simulation and maneuverability practice.

What should training programs include?

- Practice in many and varied conditions
- Safety experience including skid mitigation; sprinkle sand or gravel on the track turn the wheels into a skid
- Wet conditions training ... hose your training track down to simulate rain
- Night riding practice come back after dinner
- Cornering ... chalk some tight corners onto the asphalt
- Cutting in and out of 'the pack' ... use witches hats
- Passing slow vehicles ... use a bicycle as the other vehicle
- Defensive driving techniques - be ready for the unexpected.

The RACV Energy Breakthrough LICENCE

Maryborough, Victoria, Australia



The licence holder named, has completed track safety and vehicle maneuverability and has read and is familiar with the Trial regulations, including:

- ☐ **Simulated skid and wet conditions**
- ☐ **Night riding**
- ☐ **Maneuverability**
- ☐ **Cutting in and out**
- ☐ **Traffic lights and flag signals**
- ☐ **Track conduct**
- ☐ **Pit procedure**

Signature of Principal

Signature of Student

Signature of Teacher in Charge

Date: _____

THE FINE PRINT

When each rider presents a copy of this licence, signed by the Principal and Teacher in Charge, it will be assumed that they have undergone a track safety skills and maneuverability program. When said licence is presented at the Design and Construction session, it will be taken into consideration during obstacle course testing. However, if no licence is presented, any number of riders in your team will be required to demonstrate competence in vehicle control by undergoing a tough test. Safety is the number one priority at the **RACV Energy Breakthrough**.

8. What Do We Need?

Paperwork

You will need to have filled in:

- **an official entry form for each team entered: completed and returned by the due date**
- **a licence for each rider (see section 7)**
- **your school's normal Excursion Permission Forms (see below).**

Timeline

The receipt of your entry form will be acknowledged by the organisers.

Throughout the year, you will receive newsletters with further information and shared ideas about Energy Breakthrough. Newsletter articles are always welcome. Feel free to submit updates on your teams progress, good learning programs or curriculum materials. Please feel free to contribute to the newsletter by contacting the RACV Energy Breakthrough Office.

In **early November**, you will receive an Information Kit, which will provide all details for participating teams about the Maryborough event, including schedule of times for assessment tasks, and other organisational requirements.

Teams wishing to change their Category or any details relating to entries should e-mail (breakthrough@cgoldshire.vic.gov.au) or fax (03 5461-0666) this information to the RACV Energy Breakthrough Office.

Please Note:

Teams registered in the HPV B or C class and requesting a transfer to HPV Open will incur a 50 lap penalty in the trial.

Safety

Make sure you fulfill all Department requirements (including insurance), **AS YOU WOULD FOR ALL SCHOOL EXCURSIONS**. This includes the completion of police checks of all attending parents and volunteers as per the requirements of the Working with Children Act.

While every precaution is taken to make the weekend as safe as possible (including first-aid facilities and on-going safety checks) no responsibility can be taken for teams. Be especially careful to ensure that helmets and other safety equipment are organised well before the event.

Please ensure your team is aware of the first-aid stations situated across the precinct.

9. How Do We Get Involved?

How to Enter

There is an entry fee for each entry which covers your camping fee and administrative expenses.

[\\$ 20.00 ... for each Innovations entry \(max \\$100 per school for unlimited entries\)](#)

[\\$ 190.00 ... for each Pushcart team.](#)

[\\$ 300.00 ... for each Human Powered Vehicle entry.](#)

[\\$ 300.00 ... for each Hybrid Powered People Carrier entry.](#)

[\\$ 300.00 ... for each Try-athlon entry.](#)

Please note: No refunds except for teams on a waiting list that are not offered a place.
All entry fees are GST inclusive.

The entry form will be available from the RACV Energy Breakthrough website from March 9th., 2010.

The entry form should be completed and returned by POST and with PAYMENT to:

THE 2010 RACV ENERGY BREAKTHROUGH
PO Box 194, Maryborough, Victoria, 3465

No later than

Friday 7th May 2010 ... HPV, Try-athlons and Hybrids

Friday 25th June 2010 ... Pushcarts and Innovations
(Last day Term 2)

Sponsorship

Individual entries are encouraged to negotiate sponsorship with local businesses or service groups. Such support must be consistent with the health and welfare of young people and the overall objectives of THE RACV ENERGY BREAKTHROUGH. If you have any doubts about the suitability of a sponsor, please contact RACV Energy Breakthrough office **5461 0621**.

There are enormous promotional opportunities for sponsors of teams and the event itself. Entrants should ensure that sponsors receive a good return for their investment. This includes maintaining a good relationship with sponsors, generating media coverage and reporting back to the sponsors on what their funds have enabled.

Any organisations interested in supporting the RACV ENERGY BREAKTHROUGH should contact the office on **5461 0621** for information.

Volunteer

There are endless opportunities for individuals and groups to volunteer for the RACV ENERGY BREAKTHROUGH. These opportunities range from Administration and site set-up for those of all ages to stage announcing and the on-site newspaper, the Breakthrough Bugle. Please register your interest via the www.racvenenergybreakthrough.net website.

10. How Can We Find Out More Information?

Official event website:

For curriculum resource ideas, forums, advice & assistance, for sale, photos, results from previous events, further event info event and news, check the Energy Breakthrough web-site:

<http://www.racvenergybreakthrough.net>

The website is proudly hosted by:



Environmental Information

There are many useful websites that can assist with your understanding of the links between transport and the environment. The following sites are suggested as a good start for you and your students:

www.greenhouse.vic.gov.au

www.epa.vic.gov.au

www.racv.com.au

Motoring section and search ENVIRONMENT.

Video

Videos of previous RACV ENERGY BREAKTHROUGH events are available from the Central Goldfields Shire Council offices in Maryborough – Phone 03 5461 0621.

Or online via the **Energy Breakthrough YouTube channel:**

<http://www.youtube.com/EnergyBreakthrough>

Publicity

Through newsletters, registered teams will be kept informed about Energy Breakthrough activities, issues, seminars, student initiatives and other newsworthy events. The organisers will be promoting the program through general media releases. They will also prepare publicity material that can be used or adapted by participants.

Please note: When you refer to the event in any publicity material, always refer to it as:

‘THE 2010 RACV ENERGY BREAKTHROUGH’

Also please keep the Energy Breakthrough office informed of any newsworthy developments in your area that would be suitable for broader media release.

Part B: Resource Manual

This **Resource Manual** contains:

- The 2010 **Programs**
- Information about **Track Safety Skills**
- **Specifications** for the four Categories
- **Trial Regulations**
- The **Entry Forms**
- A **Map** of the Maryborough site

11. Program

(i) Innovations in Technology

THURSDAY 18 NOVEMBER

No activities

FRIDAY 19 NOVEMBER

All Day

Teams Register

Innovations in Technology teams must register on Thursday or Friday. Saturday registrations will only be completed by prior arrangement with organisers.

SATURDAY 20 NOVEMBER

9.00 am - 3.30 pm

Crafty Design and Moving Water Assessment

- Design & Construction
- Display & Presentation
- Performance Test

2.00pm

Crafty Design Performance Test

4.30 pm

Primary School Presentations

Stage in Pushcart Marquee area

- Innovations in Technology
- Pushcarts
- HPV A

SUNDAY 21 NOVEMBER

No activities

(ii) Pushcarts

THURSDAY 18 NOVEMBER

All Day: Teams arrive and set up camp

9.00 am Registration opens

1.00 pm - 5.00 pm **Scrutineering**
Pushcart Marquee

FRIDAY 19 NOVEMBER

8.30 am **Compulsory Meeting of Team Manager and Captain**
Pushcart Marquee

9.30 am – 3.00 pm **Display and Presentation**
Pushcart Marquee

10.00am – 12.00pm **Obstacle Course (Group A)**
Pushcart Marquee

1.00pm – 3.00pm **Obstacle Course (Group B)**
Pushcart Marquee

4.00 pm – 6.30 pm **Endurance Event**
RACV Track

SATURDAY 20 NOVEMBER

9.00 am **Design and Construction**
Pushcart Marquee

11.00 am **Sprint Event**
RACV Track

2.00 pm **Design and Construction**
Pushcart Marquee

4.30 pm **Primary School Presentations**
Stage in Pushcart Marquee area

SUNDAY 21 NOVEMBER

No activities

(iii) Human Powered Vehicles - Class A

• ***All Track activities are on the HOLDEN TRACK***

THURSDAY 18 NOVEMBER

9.00 am Registration Opens

9.00 am – 5.00pm **Display and Presentations**
(A specific time for each team to do their Display & Presentation will be included in the Information Kit to be sent to schools in November).

9.00 am – 5.00pm **Design and Construction and Scrutineering**
(A time for each team to complete their Scrutineering and Design & Construction will be included in the Information Kit to be sent to schools in November. Teams **MUST** complete these assessments within the time allocated).

5.30 pm Rider Briefing - near HOLDEN Bridge

6.00 pm – 8.00 pm Practice

***All teams should have arrived and
registered by 3.00 pm on
Thursday.***

FRIDAY 19 NOVEMBER

11.00 am Team Managers' Briefing - near HOLDEN Bridge

11.30 am Assembly of Starting Grid

12.00 noon **HPV A Trial Start**

9.00 pm Compulsory HPV A Break

SATURDAY 20 NOVEMBER

6.00 am **HPV A Restart**

11.00 am **HPV A Trial Finish**

4.30 pm **Primary School Presentations**
Stage in Pushcart Marquee area
(HPV A, Pushcart and Innovations in Technology)

SUNDAY 21 NOVEMBER

No activities

(iv) Human Powered Vehicles - Classes B, C, & Open

• All Track activities on RACV TRACK

THURSDAY 18 NOVEMBER

All Day Teams arrive and set up camp

11.00 am Registration Opens

FRIDAY 19 NOVEMBER

All Day Teams arrive, register, set up camp, set up displays etc.

8.00 am - 6.00 pm **Design and Construction** assessment, **scrutineering**
(A time for each team to complete their Scrutineering and Design & Construction will be included in the Information Kit to be sent to schools in November. Teams **MUST** complete these assessments within the time allocated).

8.00 am - 6.00 pm **Display and Presentation**
(A specific time for each team to do their Display & Presentation will be included in the Information Kit to be sent to schools in November).

6.00 pm **Team Managers' Meeting** – Jubilee Oval Pavilion.

6.45 pm Assembly for Night Practice

7.00 pm – 9.00 pm **Night Practice**

SATURDAY 20 NOVEMBER

12.30 pm **Assembly of Starting Grid**

1.30 pm **Start of Secondary HPV 24-hour Trial**

SUNDAY 21 NOVEMBER

1.30 pm **Finish of Trial**

1.45 pm **Presentation of Trophies** (Secondary)

Afternoon Pack up and depart.

Note: Teams may stay overnight on the Sunday after the event to ensure that the team travels home safely.

(v) Hybrid Vehicles

- **All Track activities on HOLDEN TRACK**



THURSDAY 18 November

All Day **Teams arrive and set up camp**

11.00 am Registration Opens

FRIDAY 19 NOVEMBER

All Day Teams arrive, register, set up camp, set up displays etc.

8.00 am - 6.00 pm **Design and Construction** assessment, **scrutineering**
(A time for each team to complete their Scrutineering and Design & Construction will be included in the Information Kit to be sent to schools in November. Teams **MUST** complete these assessments within the time allocated).

8.00 am - 6.00 pm **Display and Presentation**
(A specific time for each team to do their Display & Presentation will be included in the Information Kit to be sent to schools in November).

6.30 pm **Team Managers' Meeting** - near HOLDEN Bridge

9.15 pm Assembly for Night Practice

9.30 pm – 11.00 pm **Night Practice**

SATURDAY 20 NOVEMBER

10.00 am **Hybrid Vehicle Fuel-up**

12.30 pm Assembly of Starting Grid

1.00 pm **Start of Hybrid 24-hour Trial**

SUNDAY 21 NOVEMBER

1.00 pm **Finish of Trial**

1.45 pm **Presentation of Trophies** (Secondary)

Afternoon Pack up and depart.

Note: Teams may stay overnight on the Sunday after the event to ensure that the team travels home safely.

(vi) Powercor Try-athlon



THURSDAY 18 NOVEMBER

- All Day** Teams arrive and set up camp
- 9.00 am** Registration Opens – Administration Centre
- 1.00 pm – 5.00 pm**
- **Scrutineering** – Marquee Area
 - **Design and Construction Assessment**
(A time for each team to complete their Scrutineering and Design & Construction will be included in the Information Kit to be sent to schools in November. Teams MUST complete these assessments within the time allocated).
 - **Display and Presentation Assessments**
(A specific time for each team to do their Display & Presentation will be included in the Information Kit to be sent to schools in November).
- 7.00 pm** **Team Managers Meeting** – Location Near Administration Centre
- 7.45 pm** **Timekeepers & Observers Meeting** – Location Near Admin Centre

FRIDAY 19 NOVEMBER

	9.00am – 11.00am	11am – 1pm	2pm – 4pm
Obstacle Rally (RACV Track - near stage)	A Class (Primary)	Open Class	B/C Class
Time Trial (RACV Track - back straight)	B/C Class	A Class (Primary)	Open Class
Break / Marshals	Open Class	B/C Class	A Class (Primary)

- 6.30 pm** **Team Managers' Meeting** - near HOLDEN Bridge
- 9.15 pm** **Assembly for Night Practice** – Holden Track
- 9.30 – 11.30 pm** **Night Endurance Trial Practice** – Holden Track

SATURDAY 20 NOVEMBER

- 1.00 pm - 9.00 pm** Try-athlon Endurance - HOLDEN track
- 10.30 pm** Try-athlon Presentations - HOLDEN Stage

PLEASE NOTE: No vehicles or trailers will be allowed in the Try-athlon pit areas.

SUNDAY 21 NOVEMBER

- All Day** No activities, Pack up and depart.

12. Track Safety Skills

This year's assessment will once again include a check of your driver skill levels. Your team's preparation should include some theory and practice in driving a machine on a defined track.

Here are some points you can work on:

TRAFFIC LIGHTS / FLAG SIGNALS

All team members must understand the meaning of the flag signals. The traffic lights/flag signals are the main way for Marshals and Traffic Officials to communicate with riders during the trial. During Design and Construction assessment members will be questioned about their knowledge of Traffic Lights/Flag Signals and track Conduct.

DRIVER POSITION

Each team driver should be able to reach the pedals and be comfortable over their full range of movement, without stretching the leg straight. Make sure the back is fully supported so that maximum effort can be applied to the pedals without needing extra support gained by pulling back on the steering wheel. The seating position for each rider must comply with specification 4.2.1 and enable each rider to satisfy the vision requirements specified in 2.3 (HPV & Hybrid Specifications).

Both mirrors should be adjusted so that a vehicle following close behind – just to one side or other side – can be clearly seen without undue head movement.

Seat belts must be worn low over the pelvic bone (not high over the waist) and across the chest. The belt should be comfortable, firm and not prone to slipping off the shoulder. The seat position must ensure that the rider does not slide forward and under the seat belt.

CORNERS

A Blue Line is marked on the track. Vehicles are required to stay on the inside of the track (that is to the **left** of the blue line) at all times unless overtaking.

When entering a bend, look where you want the vehicle to go – this will help to pull you through in a smooth curve.

MIRRORS

You must always be using your mirrors to know what is behind you, or if you are going to be overtaken, and to be aware of vehicles around you.

Finally, if you are planning to move from one side of the track to the other, give a quick glance over your shoulder to avoid moving into the path of another vehicle.

STEERING THE VEHICLE

Use a light grip on the steering wheel or levers; push the pedals from the hips, back and shoulders, with relaxed arms. This will allow you to steer smoothly and keep a straight line.

Innovations in Technology



Challenge 1: Crafty Design

The challenge for **Crafty Design** is to create a craft that resembles some of the Macro invertebrates that live in and around the water. Macro means that we can see it with our eyes. Invertebrates are small animals and are a collective term used for all animals without a backbone which include spiders, crustaceans, worms, insects and molluscs. There will be a special prize for those who demonstrate they have met the objective.

One of the Macro invertebrates we at Waterwatch are intrigued with is the Mayflies; the mayfly nymphs can be identified by their three tails. They are found throughout Australia inhabiting streams, rivers, wetlands and pools, under bark, logs and rocks. The Mayfly nymphs all graze on algae or plants or consume detritus. Secondary students are encouraged to create other ways for craft to travel, e.g. craft must still have contact with water; under water.

Using construction materials such as TEK0, LASY and LEGO in conjunction with scrap material, create a stable craft (in keeping with the above theme) which will run under its own power, along a channel of 9.4 metres x 81.5 cm, carrying a full soft drink can. Please note that the water depth of the channel is approximately 12 cm. Craft must complete one full length of the channel. Craft dimensions: length and width to be under 81.5 cm.

The fuel source must be an alternative to fossil fuel. No dry cell batteries or capacitors permitted.

The craft must be able to maintain a direction within a lane, towards a designated target area on the end and must complete the course within a set time of three minutes.



Challenge 2: Moving Water Wet-N-Wild

Open to Primary & Secondary Students

This challenge for **Moving Water** is to create a water cycle catchment model. The main aim is to represent a typical Australian catchment. The model should show pollutants entering the stormwater system as the water moves along and down the river. Our best-case scenario would be for teams to remove all pollutants from the streams prior to entering the sea (this may be carried out through an osmosis process).

A further challenge is to move WATER from one side of a mountain to the other on your water cycle catchment model. In doing this the following criteria apply:

- Teams cannot drill or tunnel through the mountain.
- Hot, dry summers in the area mean that the rate of evaporation is very high. Therefore teams must minimise the amount of water lost along the way.
- As well as providing irrigation water, the force of the moving water is to power at least two (2) devices along the way.

Show how the problem can be solved by constructing a scale model according to the following guidelines:

- As far as possible, the power of moving water must be used. One other power source may be used, but it must be an alternative to fossil fuel. Is it possible to use water as the only power source?
- No more than 10 litres of water will be supplied for use in demonstrating how the model works.
- Pipes, tunnels, tubes, whirligigs, turbines, waterwheels, etc can be incorporated into the model.
- The model must be no larger than one metre cubed.
- Virtually all of the water used by the model must be retrieved/recycled.
- The model should have 'real world' appearance, be colourful and full of action.
- Consider: a) how to use the water at the sea/ocean to generate power; b) the use of dams for potential of stored energy.

JUDGING OF INNOVATIONS IN TECHNOLOGY

All information relating to assessment of **Crafty Design** and **Moving Water** is to be presented on a **poster** approximately 65cm wide x 85cm high (thick cardboard backing is recommended).

Each team will be allocated 20 minutes in which to **present and discuss** their entry with the judges.

Judging will include assessments in the following areas and to be included on the poster:

- Safety - includes energy source, the load (soft drink can), moving parts shielded.
- Innovative Construction - materials used, design originality, community involvement. Use of recycled material (teams should look to improving craft each year and modify). Recycling does not mean use of exactly the same model. Recycling of materials – NOT CRAFT!
- Planning and Testing - includes challenges, problems encountered during planning/construction, modifications.

- Presentation – use of diagrams, photos, colour, originality, evidence of teamwork, involvement of school, community and/or industry.
- Cross Curricular Aspects – demonstration that project has been incorporated into subject areas at school.
- Model/Craft: Potential, Appearance and Sustainability – use of originality and imagination, artistic form, sustainability of model working, student input, ability to identify how the model could be improved, given time and appropriate materials.

Performance Test and Time Trial

All entries are required to demonstrate their crafty design/water catchment model in operation, and complete a **Performance Test**.

During the performance test, the craft/model will be judged on how it shows advancement in technology along with its reliability, sustainability and efficiency. Higher marks will be awarded for completion of task in a given time without any assistance from the team.

The performance test will involve a time trial for Crafty Design entries – this takes place at the water tanks at 2.00 pm.



Central Highlands Water is committed to environmental Education. They are proud sponsors of the Innovations in Technology section of the RACV Energy Breakthrough and are looking forward to helping provide hands-on learning opportunities for Breakthrough participants again in 2009.

Central Highlands Water has developed a unique Environmental Education Centre, which has been recognised nationally as a finalist in the prestigious Banksia Environmental Awards and the Victorian Landcare Awards.

The latest addition to the Central Highlands Water Education Centre for 2005 is the 'Gong Gong Wetlands'. This new and vibrant exhibit is a tour of self-discovery of wetlands and their ecological benefits to the environment.

Visitors and school groups who visit the wetlands can explore above, below and beside the water for information on some of the native plants and animals that live and depend on water. The 'Gong Gong Wetlands' demonstrates that water is truly the **Basis of Life**.

For more Information please contact:

Peter Blackburn
The Education Officer
Central Highlands Water
PH: (03) 5320 3157

The Waterwatch Co-ordinator
Central Highlands Water
PH: (03) 5320 3199

Pushcarts - Vehicle Specifications



Designing and developing a pushcart can be an enjoyable and productive way of introducing primary students to technology, science and environmental education. The machine, powered solely by students, is based on the old fashioned billycart.

An integral part of the building of this pushcart involves students thinking creatively and innovatively in the design, development and construction of such a vehicle to ensure that it performs efficiently and effectively across all areas of the event.

There are two sections in the pushcarts:

- **Section 1: schools with 150 or less students**
- **Section 2: schools with more than 150 students.**

GENERAL REQUIREMENTS

- Teams of between eight and ten students will, with assistance if required, design and build a pushcart according to the specifications which follow.
- Each team must comprise of at least 50% females.
- All team members must participate in the Design and Construction and Display and Presentation elements of the event.
- Each team member must participate in at least two of the three track components: sprint, endurance and obstacle.
- The team may obtain the assistance of other students, parents, friends, local trades people, community groups, etc, in the development of the pushcart. However, adults and other students are not permitted to assist the team when competing.

DESIGN REQUIREMENTS

General

- The basic design is a billycart with four wheels, a roll-push bar, a brake and front steering. (Roll bar can be push bar or they can be separate.)
- Any construction material may be used, provided that the safety requirements are met. No car or motorbike parts may be used except seat belts, which are a safety item.
- Every component of the cart in its dismantled state must fit into an imaginary box 10 cm deep. The cart can be as high or as elaborate as desired providing it can be disassembled to meet this requirement.
- The front of the pushcart must have foam protection (minimum of 4 cm thickness of foam) to prevent injury should the cart collide with another, or the feet or legs of another pusher.
- Moving bolts on the pushcart must have lock nuts or double nuts **or be designed** so that they don't work loose during the trial.

Brakes

- A brake must operate on at least one rear wheel. The brake control or pedal must be controlled by the rider and have a definite 'off' position.
- The brake is to be operated by the driver.

Wheels and Steering

- Wheels, including tyres, must not exceed 250 mm in diameter.
- Front wheels must not contact the cart on full steering lock causing front wheels to lock.
- The steering is to be operated by the **driver**, that is, not the pusher.

Safety

- Protruding bolts must be cut off and jagged edges filed smooth.
- The design shall be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators.
- The roll bar must provide protection to the driver. It must be at least 100 mm above the head of the tallest team member while sitting in the pushcart. It can also serve as a push bar.
- Each member of the team must wear knee and elbow pads, an approved bicycle helmet and protective gloves.

SEAT BELTS

Type

- The vehicle shall be fitted with an approved (Australian Design Rules) adult three point (minimum) automotive static or inertia reel seat belt.
- Automotive full harness types are acceptable.
- The seat belt will be completely standard, including buckle, stitching and mounting plates and must be adjustable for each individual rider.
- Second-hand belts free of visible damage are acceptable.
- Seat belts must be adjustable to fit all individual team members.

Mounting

- The seat belt should be mounted to a major structural, non-moving member of the cart.
- Upper belts should be mounted behind the rider's shoulders, to suitably braced points on the roll bar.

Stability

- If a rear step is installed to enable the pusher to scoot the vehicle, the cart must be stable while the heaviest pusher is standing on the step and the lightest driver is sitting in the pushcart.
- Pushcarts must demonstrate stability to compete in all events of the Breakthrough.

VEHICLE IDENTIFICATION

- Each vehicle is required to have two white identification panels measuring 100 mm x 100 mm for displaying the team's number. These panels must be fitted to the side and the front of the pushcart. They must be pliable and not constitute a danger to pusher or driver. Numbers will be supplied on registration.
- An 'RACV Tested' sticker will be supplied after the scrutineering 'all clear' has been obtained. This is to be displayed above or below the number at the front of the pushcart. Provision must be made for this in the front identification panel.
- Provision may need to be made for the display of sponsor panels.

SCRUTINEERING

- All teams must present their pushcart and eight team members to the judges for scrutineering of safety requirements before participating.
- An RACV Tested sticker will be allocated to teams after successful completion of scrutineering.
- Pushcarts will not be permitted to participate without a sticker.

PUSHCART EVENTS

Design and Construction

The purpose of Design and Construction is to assess the team's knowledge and understanding of the pushcart and its design and construction. This event also enables the judges to assess teamwork, practical skills and understanding as well as the design features of the vehicle. In this component, they will be looking for:

- **competence at assembly**
- **innovation in design**
- **construction of pushcart**
- **overall team approach**
- **use of recycled materials**
- **technology skills**
- **involvement of other people in design.**

Within the Design and Construction component, each team (without support crew) will be required to:

- rebuild the dismantled pushcart within 30 minutes. In the unlikely event of a team taking more than 30 minutes to assemble the pushcart, the attempt will be abandoned for assessment purposes.

The Trials

- A Sprint relay, Obstacle and an Endurance Relay will test all aspects of vehicle design, construction and reliability as well as student fitness and teamwork. All teams must participant in all three elements.
- The sprint relay will be conducted over a 50 metre straight track with eight team members having a turn of pushing and driving.
- Four team members will be required negotiate an Obstacle Course on both sealed and grassed surfaces.
- Points will be allocated on the basis of time.
- The Endurance Relay will be conducted on a street circuit with eight team members each having a turn of pushing and driving. Each person will be required to push for approximately 250 metres and then drive for approximately 250 metres before change-over.
- Power for the vehicle must come solely from the single team member who is pushing the pushcart.
- The pusher may ride on the back of the cart while scooting along.
- Ultimate success on the track will depend as much upon fitness and teamwork as on the design of the vehicle.

Display and Presentation

The purpose of Display and Presentation is for all team members (maximum of 10) to demonstrate their knowledge and understanding of the entry.

The team will be required to present a record, visually and orally, of:

- The various aspects of the project
- How the pushcart was developed
- What problems arose and how they were overcome
- Sketches, mock ups
- How other students and other people were involved
- How studies were integrated in the development of the pushcart
- How the team prepared for the Breakthrough.

NB: The display area is **not** to exceed 2 x 2 metres.



Human Powered Vehicles - Vehicle Specifications



Please note these Vehicle Specifications also cover the Powercor Try-athlon category.

1.0 SCOPE & CONFIGURATION

1.1 Intent

The human powered vehicle category is intended as an experiment in personal mobility. The objective is to build an efficient and stable machine powered entirely by human effort.

Entrants must:

- **Design and build a vehicle 'from a clean sheet'**
- **Develop or adapt a vehicle from an existing design**
- **Liaise with local industry or community groups to design and build a machine.**

The RACV Scrutineers have the final authority to decide if any vehicle or team competes in the event, based on safety and their interpretation of the following rules.

Clarification of rules and specifications sought from the RACV must be submitted in writing or by e-mail and a copy of and a copy of responses presented at scrutineering.

1.2 Seating Capacity, Wheels

The vehicle shall carry a rider alone, and shall have three or more load bearing wheels arranged in a stable configuration.

1.3 Riding Position

The riding position shall not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. (See Section 4.2.1)

1.4 Power Source

Motive power shall be entirely supplied by the rider.

2.0 DESIGN AND MATERIALS

2.1 Inherent Safety

The design shall provide protection for the rider in the event of a collision or rollover. (See Sections 2.3 and 4.0). The design must be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators. Vehicle control and stability shall not be jeopardised by inappropriate design and construction methods.

2.2 Exclusions

Choice of design and construction materials is free, except that:

- The use of bicycle components shall be restricted to centre brackets, head stems and wheel dropouts with minimal use of adjacent original frame tubing.
- Tilt steering and flexible steering columns are prohibited.
- There must be a forward clearance of at least 300 mm between the rider's face and the steering wheel.
- Teams planning to construct vehicles with rear-wheel steering are advised to consult with the RACV and will be required to attend a Pre-Scrutineering Day.

2.3 Bodywork

Fully or partially enclosed bodywork is encouraged. In any case the bodywork design and structure will be regarded as supplementary in terms of rider protection and is not a substitute for compliance with the roll bars and side intrusion protection requirements (See Section 4.1.1)

Where enclosed bodywork is fitted:

2.3.1 Clearances and Access

- There must be a forward clearance of at least 300 mm between the [rider's face](#) and any bodywork.
- The rider shall be able to open and/or remove bodywork and exit the vehicle without external assistance in less than 6-seconds.
- Bodywork shall be capable of being opened and or removed from outside the vehicle independently of the rider in an emergency.

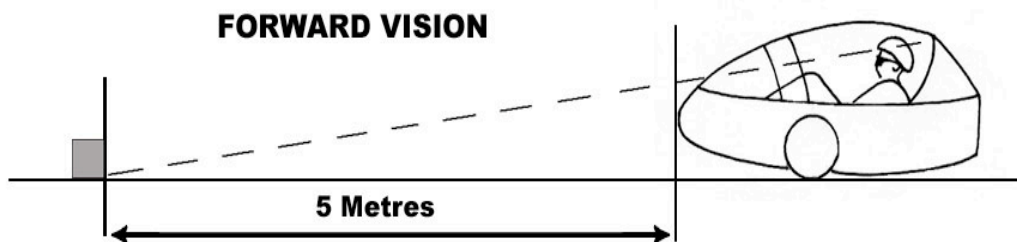
2.3.2 Vision and Ventilation

- Rider and vehicle safety shall not be impaired by restricted ventilation or visibility.
- Provision for rain and fogging must be demonstrated.
- Rider vision must not be impaired by excessively enclosed and restricting bodywork.

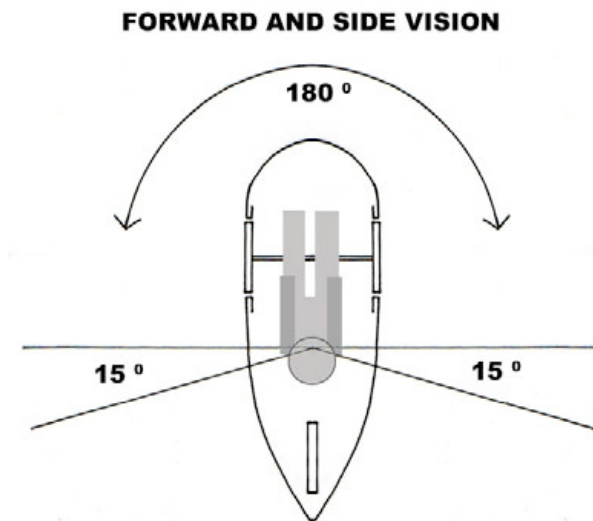
Vision Tests:

Riders seated in the normal riding position are required to pass the following vision tests during scrutineering:

1. Sight an object on the road 5 metres in front of the vehicle.



2. Sight 180 degrees ahead of the rider, and other vehicles 15.0 degrees behind the rider on each side of the vehicle by turning their head. The intent of this clause is that a rider is able to turn their head to visually check for other vehicles before changing their position on the road.



3.0 VEHICLE DIMENSIONS

Length

2700 mm maximum

Width

1100 mm maximum

Height

1200 mm maximum

Wheelbase

1000 mm minimum wheelbase between the most forward and most rearward axles.

Track

600 mm minimum lateral distance between outermost wheels measured at ground level.

Turning circle

8 metre diameter maximum between kerbs in either direction.

4.0 OCCUPANT PROTECTION

4.1 Protection Bars

Vehicles must have three protection bars;

1. "Head bar" (main bar) including brace,
2. "forward leg bar" including brace, and
3. "side intrusion bar"

Construction

All protection bars, including bracing must be made using one of the three following materials and construction methods:

4.1.1 Steel or Chrome molly

Steel or chrome molly tubing no less than 12.7mm outside diameter (preferably welded)
(See Section 4.2.4)

4.1.2 Aluminium

Aluminium tubing no less than 16.0 mm outside diameter (preferably welded)
(See Section 4.2.4)

4.1.3 Composites

Fully enclosed bodies made from composites such as Carbon-Fibre Fibreglass or Kevlar can use integral composite roll bars and side intrusion bars provided they comply with the following requirements:

- Composite roll bars must be a shaped rib moulded integrally with the body and of at least equal strength to a metal roll bar. (eg: The roll bar area should not be able to flex when pressed by hand)
- All composite roll bar and side intrusion bar ribs must follow the same positioning as the steel protection bars.
- A sample of the composite construction will be required for inspection at scrutineering.
- All composite constructions must have finished edges. That is no protruding fibres or frayed edges.
- Metal roll bars can be used with composite bodies. Any joins must follow the plate mounting method as described in 4.1.4 Plate Joints.
- All newly constructed vehicles with any of their protection bars made from composite materials (eg Carbon Fibre, fibre glass, kevlar) MUST have the vehicle inspected by RACV at a Pre-Scrutineering Day prior to the Energy Breakthrough event. Details to be advised.

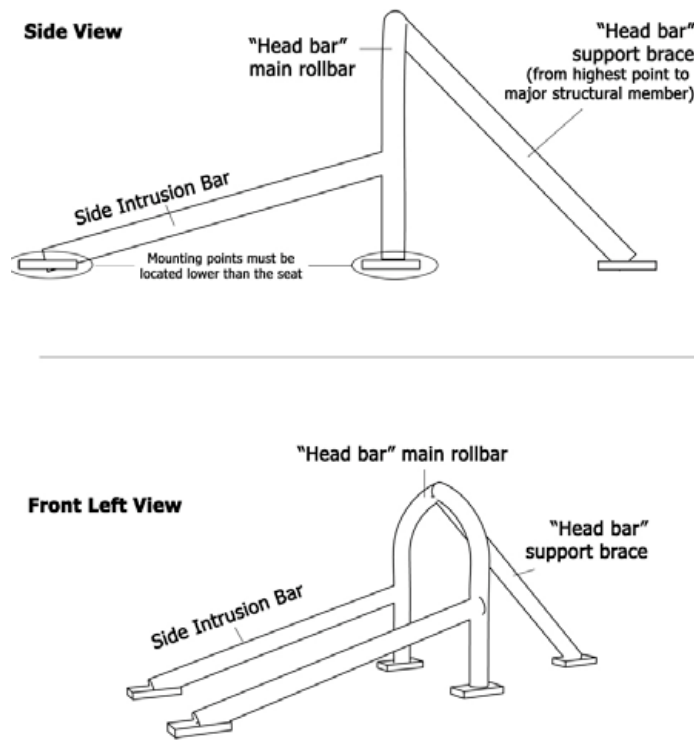
The onus is on schools to ensure that their vehicle is compliant with the required safety standards. The RACV Energy Breakthrough website includes some advice on composite construction in the 'Downloads' section.

4.1.4 Plate Joints

- Metal protection bars should be welded where possible.
- Alternatively, the protection bars may be joined by bolting together 2 flat metal plates no less than 60mm x 60 mm square in size and at least 3mm thick.
- The plates must be welded to the roll bar and joined using at least two 6 mm bolts with locking nuts (eg-Nylock Nuts).
- Corners and edges should be rounded and smoothed off.
- Where there is composite material between the two plates, spacers must be used to prevent crushing of the composite.

4.1.5 Role of Bodywork in Occupant Protection

- Fully enclosed bodywork alone does not fulfil the protection bar requirements, so all vehicles require protection bars meeting all construction specifications, regardless of bodywork.



4.1.6 Head Bar

The main head bar and brace together with the side intrusion bars must be one continuous welded frame, constructed according to the diagram above and must be solidly attached to the vehicle frame. (See Section 4.1.2: Plate Joints)

The "head bar" hoop must be braced from its highest point with one bar, preferably two, to a major structural member to form a tripod. If this frame is concealed within a composite body an inspection hole must be provided.

Note: The diagrams above show secure mounting plates; teams can use other mounting approaches but it must be solid, and able to support the weight of the vehicle and rider in a rollover.

4.1.7 Leg Bar

The "leg bar" (forward bar) must protect the riders legs, knees and feet from contacting the ground in a rollover or side slide situation and must be mounted across the vehicle above the riders knee area.

The "leg bar" must be braced to prevent the bar from folding over in a rollover or sliding situation.

The protection bars (head bar & leg bar) must be able to support the weight of the vehicle and rider in a rollover (a 40km/h impact is equivalent to dropping the vehicle on its roof from a first floor landing).

NOTE: *The test for this specification is that the vehicle (with the rider in the seated position must be able to be lifted off the ground by the roll bar. This test will be applied at the discretion of the scrutineers.*

4.1.8 Side Protection

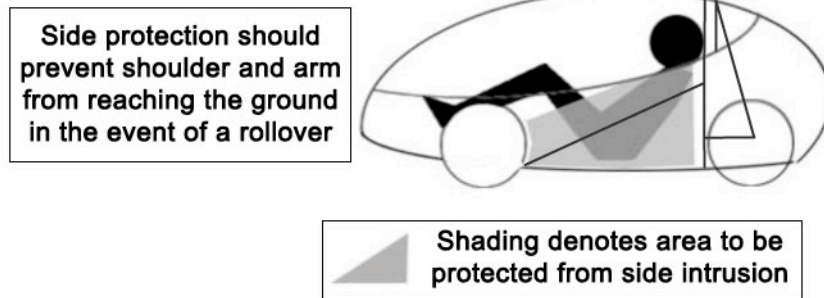
The vehicle must have side intrusion bars (as described and illustrated in 4.1.1) that are an integral part of the continuous "head bar".

In addition to the side intrusion bars, side protection bodywork or shielding is required to protect the area between the rider's hip and shoulder from making contact with another vehicle and to prevent the rider's shoulders and arms from reaching the ground in the event of a rollover.

This side protection bodywork should be constructed from suitably strong materials that will withstand sliding contact with the road.

No part of the rider is allowed to protrude outside the side protection during normal operation and there must be a clearance of 50mm between any part of the rider and the shielding.

SIDE IMPACT PROTECTION



4.1.9 Rider Protection Bar Clearances

With the tallest of the competing riders in the normal riding position, the “head bar” must be fully visible outside the rider silhouette when viewed from the front or rear.

A straight line from the top of one roll bar to the top of the other must have at least 50mm clearance above any part of the rider.

The head bar must conform to the following dimensions:

Measurement from helmet to inside of bar

150mm minimum

Measurement from either side of helmet to inside of bar

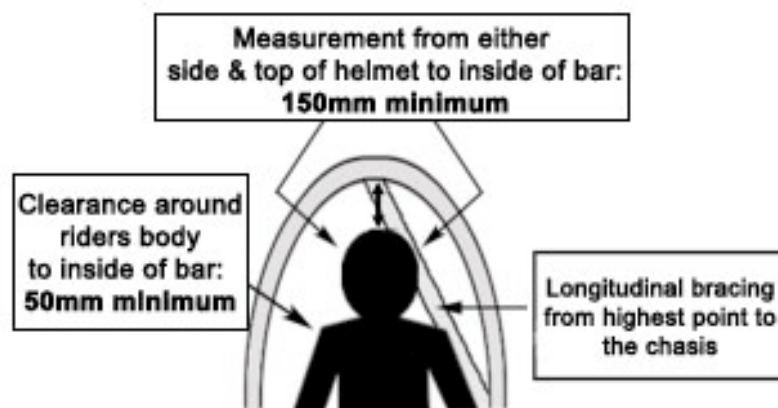
150mm minimum

Clearance around riders body to inside of bar

50mm minimum

Location forward or rearward of helmet

No more than 150mm



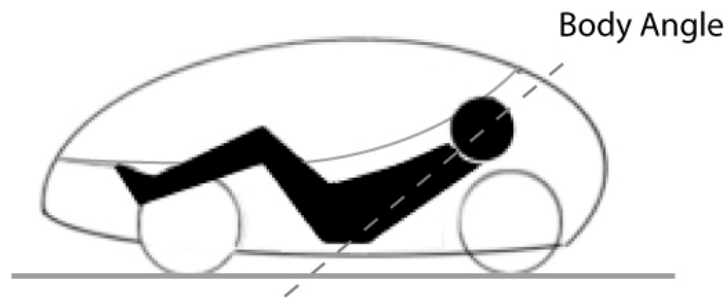
4.2 Seats

4.2.1 Position

The seat shall be fitted to ensure that the riding position does not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed.

The seat must be shaped and positioned to prevent the rider sliding under the seat belt.

In vehicles with movable seats, riders must remain fully protected by the side intrusion bars in all seat positions.



4.2.2 Locking of Seat Position

The seat must be secured and locked into position.

Adjustable seats must lock securely into position for each rider and must not move forwards or backwards. Seat belts cannot be used as part of the seat lock system.

4.2.3 Extra Padding

Any temporary or removable padding used for riders MUST be fixed into place using a positive attachment to a fixed part of the vehicle. Teams could use strap and buckle, velcro straps, dog clips, canvas zips, etc.

4.3 Seat Belt

4.3.1 Type

The vehicle must be fitted with an Approved and Certified adult Four (4) point (minimum) seat belt for all riders. Seat belts must have certification attached.

The seat belt must be completely standard, including buckle, stitching and mounting plates.

Teams will be required to demonstrate adjustment of the seatbelt to suit each rider.

Suggested suppliers:

- HEMCO INDUSTRIES, VICTORIA for price and delivery details, visit www.hemco.com.au
Wayne Fitzgerald, PO Box 444, BALLARAT VIC 3353
Ph: 03 5334 1213 Fax 03 5334 1011 hemcosb@cbl.com.au
- Klippan, Type "Street Racer" 4 point, 2 inch webbing available through Repco stores.

4.3.2 Mounting

The seat belt must be mounted to a major, non-moving, structural member of the vehicle or can be mounted to the seat provided it is suitably secured. (See Section 4.2.2)

Upper belts mounted behind the rider's shoulders are required to be no more than 40 degrees from horizontal and mounted so as not to allow the seat belt webbing to fall from the shoulders when riding.

4.3.3 Positioning

The positioning of buckles and belts on the rider's body shall conform strictly to the belt wearing requirements of Australian Design Rules (ADRs) for motor vehicles.

The relevant section of the ADR 4/01 is reproduced below:

'Seat belts are designed to bear upon the bony structure of the body, and should be worn across the chest, shoulders and low across the front of the pelvis; wearing the lap section of the belt across the abdominal area should be

avoided. Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer'.

This means seat belts must:

- be worn across the chest, shoulders and low across the front of the pelvis
- be adjusted to be as firm as possible on **each** rider
- fitted to ensure that the seat belt remains properly adjusted on each rider, at all times.

4.4 Shielding

4.4.1 Rider Protection

Chains, sprockets and gear wheels MUST be fully shielded to prevent accidental hazardous contact with rider or clothing.

Shielding or a clearance of 100mm is required between the occupant and any rotating part, such as wheels and controls, during vehicle operation.

4.4.2 Protection of other Vehicles

Chains, gear wheels and sprockets shall be suitably shielded to prevent their contact with other vehicles.

4.4.3 Shielding from Road Surface

Vehicles must be fitted with an under-tray or floor panel which prevents the rider's feet from contacting the ground when seated in the riding position.

Pedal toe clips, elastic straps or pedal-to-shoe locking devices do not fulfill the requirements of this clause.

5.0 STEERING

5.1 Type

The type of steering mechanism is free, except for:

- Tilt steering and flexible steering columns are prohibited.
- A minimum clearance of 300mm is required between the riders [face](#) and the steering wheel.
- The rider must have continuous positive control without the need for regular adjustment.
- Teams planning to construct vehicles with rear-wheel steering are advised to consult with the RACV and will be required to attend a Pre-Scrutineering Day.

5.2 Freedom from Binding and Fouling

Steering linkages shall operate freely from full left to full right lock without binding or fouling.

5.3 Lock Stops

Independent positive lock stops must be provided to limit the steering linkage movement at a maximum lock. **At full turning angle the steering arms will contact a [solid bracket](#) or are to be restrained by a cable/chain**, to prevent over centre travel, or contact between tyres or wheels against occupants, seats or frame components. (100 mm minimum clearance is required between the occupant and any rotating part).

Note: A standard Greenspeed frame does not meet this requirement

6.0 BRAKES

6.1 Independent Systems

The vehicle shall be fitted with a minimum of two (2) separate effective and independent braking systems. [Two \(2\) separate brake levers must be used.](#)

All wheels in contact with the road must have a braking capability.

6.2 Directional Stability

Brakes on the same axle line (e.g. both front wheels) must operate via a single lever, so that independent operation of any braking system shall not have the potential to affect directional stability of the vehicle. That is, the braking power of each and every braking system shall be symmetrical about the vehicles longitudinal centre line.

6.3 Simultaneous Operation

The two braking systems shall be able to be operated by the rider simultaneously.

6.4 Steering Control

Full steering control shall be maintained while braking systems are being operated.

7.0 ANCILLARY DEVICES

7.1 Lighting

The vehicle shall be fitted with the following as a minimum requirement.

7.1.1 Headlight

At least one white light, with a reflector, that has the ability to project a solid beam of light (typically 1 metre wide) onto a wall at 10 metres. (Additional lighting to improve the rider's vision is encouraged provided at least one light meets the designated requirement).

The headlight must be positioned at the front of the vehicle and between 350mm and 600mm above the road surface.

Please note: Sections of the track are in darkness at night and sufficient lighting to see the road will be required.

7.1.2 Tail Light

At least one red tail light, securely mounted on the vehicle, with a minimum lens area of 7 cm². Red flashing LED-type tail lights are acceptable.

7.1.3 Outline Lighting

The use of reflective material or strip lighting to indicate machine width and height (especially from the rear) is encouraged.

7.1.4 Mounting

All lights are required to be securely mounted for the duration of the event to maintain correct aim.

7.1.5 Batteries

Wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.

7.2 Mirrors

7.2.1 Number and Type

The vehicle shall be fitted with two flat plain or mildly convex mirrors, one on either side of the rider.

7.2.2 Positioning

Each mirror shall be positioned no lower than rider chest height and such that:

- The rider is afforded a clear view to the rear.

- The smallest rider must be able to reach and adjust each mirror from the normal riding position.

7.2.3 Size

Reflecting surface area of each mirror shall be 40 cm² minimum.

7.2.4 Mounting

Mirrors shall be rigidly mounted to non-moving chassis or body members and be free from vibration.

7.3 Warning Device

An electric audible warning device shall be fitted (e.g. smoke alarm siren) and operate from the normal riding position.

The device must not run continuously and operate via a momentary switch.

The horn must emit sound in excess of **85 dbA** measured directly in front of the vehicle at a distance of 1 metre. This will be checked at scrutineering.

7.4 Other Devices

Any other equipment, e.g. drink bottle, shall be securely mounted and shall not impair rider control in its mounting or use.

The use of MP3's or similar music /entertainment devices by riders is NOT permitted.

7.5 Speedometer

All vehicles shall be equipped with a simple electronic speedometer (e.g. Cat-eye) to monitor speed during the event (pit area speed limit of 15 kph).

8.0 MARKINGS

8.1 School Name

Each vehicle shall have their school name visibly displayed on either side of their vehicle.

8.2 Identification Panels

Each vehicle shall have three white identification panels. One of each of these panels should be visible from the front and either side.

Identification panels shall be either 250 mm by 300 mm or a circle 300 mm diameter.

Hybrid Powered People Carriers – Specifications



1.0 SCOPE and CONFIGURATION

1.1 Intent

The objective of the hybrid powered people carrier is to encourage the study of power sources and drive mechanisms in a personnel vehicle.

Entrants must:

- **Design and build a vehicle ‘from a clean sheet’**
- **Develop or adapt a vehicle from an existing design**
- **Liaise with local industry or community groups to design and build a machine.**

NOTE: The RACV scrutineers have the final authority to decide if any vehicle or team competes in the event, based on safety and their interpretation of the following rules.

Clarification of rules and specifications sought from the RACV must be submitted in writing or by e-mail and a copy of and a copy of responses presented at scrutineering.

1.2 Seating Capacity, Wheels

The vehicle shall be designed to carry either a driver alone or a driver and one passenger, and shall have three or more load bearing road wheels arranged in a stable configuration.

1.3 Riding Position

The riding position or driving position shall not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. (See Section 4.2.1)

1.4 Power Sources

1.4.1 Number of Power Source

There are two sections in the Hybrid category and in each the vehicles shall be capable of being powered by two power systems:

Section 1: Pedal Power PLUS one (1) other power source

Section 2: Two (2) power sources excluding PEDAL

1.4.2 Principle of Power Generation

The fuel allocation is only available to vehicles fitted with internal combustion engines as one of their driving sources and will only be commercially available pump fuel as supplied from normal retail outlets.

All fuel used for the trial will only be available from the RACV Scrutineers.

Alternative non pressurized fuel such as vegetable oil or bio-Diesel can only be used after consultation with the scrutineers prior to the event and in any case will only be dispensed by them.

1.4.3 Minimum Duration of Power Generation

The machine must be capable of sustained operation over a minimum period of 30 minutes when powered separately by each propulsion system.

While satisfying this requirement a power source may be used intermittently during the event to overcome particular loads, such as starting from rest or hill climbing.

The spirit of this clause is that a sacrificial form of propulsion is not acceptable.

1.4.4 Potential Maximum Speed

The maximum speed of Hybrid Powered People Carriers shall be **restricted to 60 kph**.

2.0 DESIGN AND MATERIALS

2.1 Inherent Safety

The design shall provide protection for the rider in the event of a collision or rollover. (See Sections 2.3 and 4.0). The design must be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators. Vehicle control and stability shall not be jeopardised by inappropriate design and construction methods.

- Tilt steering and flexible steering columns are prohibited
- There must be a forward clearance of 300 mm between the rider's [face](#) and the steering wheel.
- [Teams planning to construct vehicles with rear-wheel steering are advised to consult with the RACV and will be required to attend a Pre-Scrutineering Day.](#)

2.2 Frames

The design and construction of the frame must provide adequate strength and safety as specified.

2.3 Electrically powered Vehicles

2.3.1 Total capacity and type of propulsion batteries

Propulsion batteries shall be commercially available, but not necessarily of lead-acid construction.

2.3.2 Total combined mass

The maximum total combined mass of propulsion batteries (on-vehicle and reserve) per vehicle is:

Battery type	Kg
Lead Acid	100
Ni Cd	65
Ni Zn	60
Li Ion	30
Ni MH	45

Note: Where Lithium Ion batteries are used a Battery Management System **must be** carried on board that is designed to provide adequate protection during charging and discharging.

2.3.3 Mass of propulsion batteries on vehicle

Vehicles are required to carry at least one battery at all times so that the electrical circuit is complete. Batteries must be securely mounted in vehicles and all wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.

2.3.4 Fuse

A fuse (up to 30 amps) must be fitted within 200mms of the battery pack.

2.3.5 Fuel used in recharging

Fuel consumed by any recharging device will only be from the fuel allocation provided to fuel powered vehicles and as supplied by event organisers.

2.3.6 Area of solar panels

Maximum effective area of solar recharging panel/s is: Single seat 4m² or max. 500watts
Dual seat 6m² or max. 750watts.

2.3.7 Location and number of solar panels

The number of solar recharging panels is free providing the maximum panel area specified in 2.3.6 is not exceeded. Panels may be mounted on the vehicle and/or located in a separate recharging area.

Panels mounted on the vehicle may not exceed the vehicle dimensions as specified and panels can not be added to, nor removed from, a vehicle during a trial.

2.4 Vehicles/Entries powered by Internal Combustion Engines

2.4.1 Fuel types

Fuels for internal combustion engines must be commercially available pump fuels supplied by the organisers.

As indicated in 1.4.2 alternative non pressurised fuel such as vegetable oil or bio-Diesel can only be used after consultation with the scrutineers prior to the event and in any case will only be dispensed by them.

Note: Fuels that must be stored under pressure such as LPG, CNG and hydrogen are not permitted.

2.4.2 Fuel tanks

Fuel tanks must be of sufficient capacity to contain the total allocation of fuel, as indicated for that category of vehicle in Section 9.2 of the Trial Regulations. The fuel tank must be mounted using a fixed retaining bracket on a structural component of the vehicle. The fuel tank must be shielded from the rider by the firewall (see section 2.5 Firewall, below).

The fuel tank refilling cap and any other tank closure shall be capable of having a mechanical seal (wire cable-tie) applied to prevent unauthorised opening.

2.4.3 Pressurised Fuel Systems

Pressurised fuel systems can be used, that is, diesel, petrol fuel injection, providing they comply with the following:

- all fuels lines are ASA standard automotive type
- all fuel lines are crimped, or union type fittings at all ends
- all fuel lines must be securely mounted on the vehicle
- all fuel lines must be protected from heated sources and contact with any moving components
- any fuel tanks pressurised must have a relief valve that prevents pressure exceeding 10 psi and must be fitted with an metal, automotive tyre valve for testing.

2.5 Firewall

2.5.1 Description

Vehicle occupants must be separated and [fully shielded \(ie. No gaps\)](#) from any potential fire by a metal firewall that has a [minimum of 25mm](#) clearance from the rider's seat.

This firewall must shield the rider from any direct flame occurring from:

- Engine and other high temperature heat sources.
- Fuel tank and lines
- Exhaust system

2.5.2 Firewall must extend:

- **In height** - above fuel tank, fuel lines, exhaust system, engine and other heat sources or potential heat sources – as well as above the shoulders of the tallest vehicle occupant in the normal driving or riding position.

- **Downward** - to the floor line
- **In width** – As wide as the rider's shoulders, in any case sufficiently to shield occupants from hot surfaces and potential fire sources.
- Body panels must be kept clear of hot surfaces and fuel lines.

2.6 Exhaust Routing

Exhaust fumes, hot gases and vapours shall be routed to discharge clear of occupants and outside the bodywork, at the rear of the vehicle at a minimum angle to the horizontal of 45°, downward. An effective silencer shall be fitted to reduce noise, and the pipe must not protrude beyond the frame of the vehicle.

2.7 Seating Arrangements

A twin-seat vehicle may be constructed after consulting with RACV technicians on the overall dimensions of the vehicle and provided the driver has sole control of the vehicle at all times.

Both driver and passenger are permitted to monitor and make adjustments to the machine, and to contribute to the generation of energy.

2.8 Bodywork

Fully or partially enclosed bodywork is encouraged. In any case the bodywork design and structure will be regarded as supplementary in terms of rider protection and is not a substitute for compliance with the roll bars and side intrusion protection requirements (see section 4.1.1).

Where enclosed body work is fitted:

2.8.1 Clearances and Access

- There must be a forward clearance of at least 300 mm between the [rider's face](#) and any bodywork.
- The rider shall be able to open and/or remove bodywork and exit the vehicle without external assistance in less than 6-seconds.
- Bodywork shall be capable of being opened and or removed from outside the vehicle independently of the rider in an emergency.
- For twin-seat vehicles, it must be possible to exit the vehicle from either seat while the other seat is occupied.

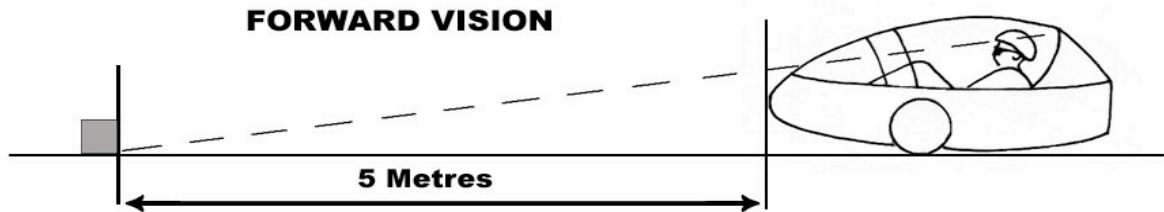
2.8.2 Vision and Ventilation

- Adequate ventilation must be provided inside the cockpit, and fumes from mechanical components and batteries must be kept separate from the cockpit area.
- Rider and vehicle safety shall not be impaired by restricted ventilation or visibility.
- Provision for rain and fogging must be demonstrated.
- Rider vision must not be impaired by excessively enclosed and restricting bodywork.

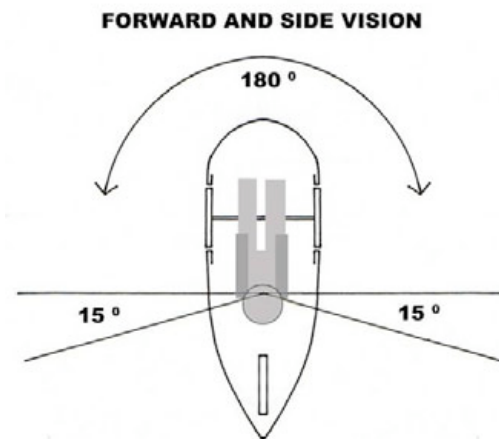
Vision Tests:

Riders seated in the normal riding position are required to pass the following vision tests during scrutineering:

1. Sight an object on the road 5 metres in front of the vehicle.



2. Sight 180 degrees ahead of the rider, and other vehicles at least 15 degrees behind the rider on each side of the vehicle by turning their head. The intent of this clause is that a rider is able to turn their head to visually check for other vehicles before changing their position on the road.



2.8.2 Materials

Materials selected for bodywork should be chosen with the following in mind:

- Most plastics – especially films – are flammable
- Many plastics give off toxic gas when exposed to flame
- Body panels shall be kept clear of hot surfaces and fuel lines.

3.0 VEHICLE DIMENSIONS

Note: Teams developing tandem vehicles which do not meet these specifications must obtain approval from the RACV Technical Committee.

Length

- 2700 mm maximum single seat
- 3000 mm maximum dual seat

Width

- 1100 mm maximum for vehicles fitted with bicycle width wheels greater than 400 mm in diameter.
- 900 mm maximum for vehicles fitted with road wheels wider than bicycle rims or less than 400 mm in diameter.

Height

- 1200 mm maximum

Weight

- 80 kg maximum for Hybrid 1
- 110 kg maximum for Hybrid 2

Note: Weights are measured without driver, fuel or batteries.

Wheelbase

- 1000 mm minimum between the most forward and most rearward axle.

Track

- 600 mm minimum lateral distance between outermost wheels, measured at ground level.

Turning circle

- 10 metres diameter maximum between kerbs in either direction.

4.0 OCCUPANT PROTECTION

4.1 Protection Bars

Vehicles must have three protection bars;

1. "Head bar" (main bar) including brace,
2. "forward leg bar" including brace, and
3. "side intrusion bar"

Construction

All protection bars, including bracing must be made using one of the three following materials and construction methods:

4.1.1 Steel or Chrome molly

[Steel or chrome molly tubing no less than 16.0 mm outside diameter](#) (preferably welded)
(See Section 4.1.2)

4.1.2 Aluminium

[Aluminium tubing no less than 19.0 mm outside diameter](#) (preferably welded)
(See Section 4.1.2)

4.1.3 Composites

Fully enclosed bodies made from composites such as Carbon-Fibre Fibreglass or Kevlar can use integral composite roll bars and side intrusion bars provided they comply with the following requirements:

- [Composite roll bars must be a shaped rib moulded integrally with the body and of at least equal strength to a metal roll bar. \(eg: The roll bar area should not be able to flex when pressed by hand\)](#)
- [All composite roll bar and side intrusion bar ribs must follow the same positioning as the steel protection bars.](#)
- [A sample of the composite construction will be required for inspection at scrutineering.](#)
- [All composite constructions must have finished edges. That is no protruding fibres or frayed edges.](#)
- [Metal roll bars can be used with composite bodies. Any joins must follow the plate mounting method as described in 4.1.4 Plate Joints.](#)
- All newly constructed vehicles with any of their protection bars made from composite materials (eg Carbon Fibre, fibre glass, kevlar) MUST have the vehicle inspected by RACV at a Pre-Scrutineering Day prior to the Energy Breakthrough event. Details to be advised.

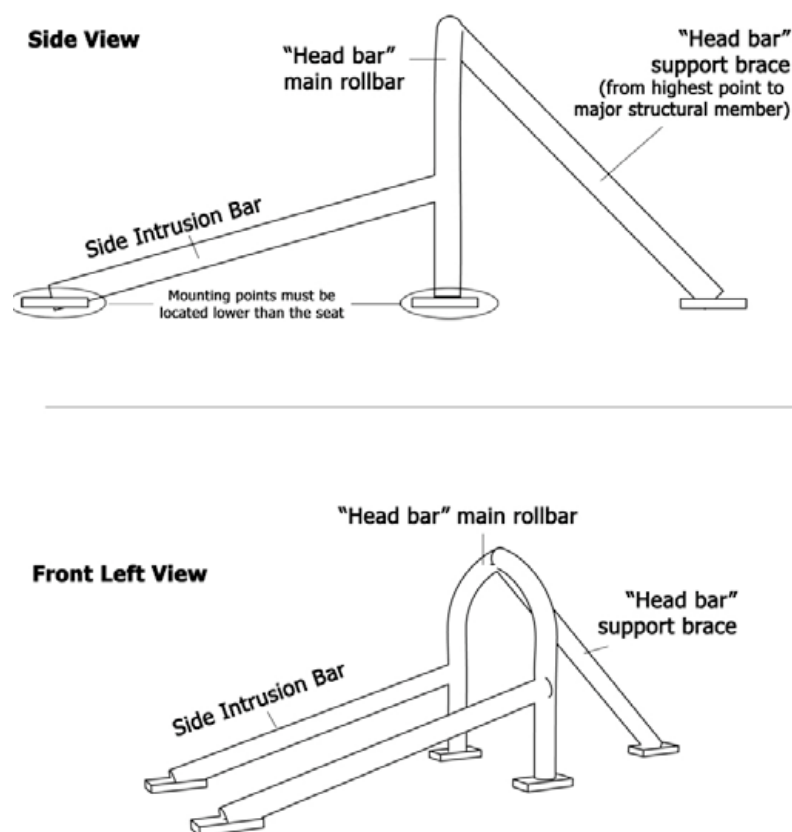
The onus is on schools to ensure that their vehicle is compliant with the required safety standards. The RACV Energy Breakthrough website includes some advice on composite construction in the '*Downloads*' section.

4.1.4 Plate Joints

- [Metal protection bars should be welded where possible.](#)
- [Alternatively, the protection bars may be joined by bolting together 2 flat metal plates no less than 60mm x 60 mm square in size and at least 3mm thick.](#)
- [The plates must be welded to the roll bar and joined using at least two 6 mm bolts with locking nuts \(eg-Nylock Nuts\).](#)
- [Corners and edges should be rounded and smoothed off.](#)
- [Where there is composite material between the two plates, spacers must be used to prevent crushing of the composite.](#)

4.1.5 Role of Bodywork in Occupant Protection

- Fully enclosed bodywork alone does not fulfil the protection bar requirements, so all vehicles require protection bars meeting all construction specifications, regardless of bodywork.



4.1.6 Head Bar

The main head bar and brace together with the side intrusion bars must be one continuous welded frame, constructed according to the diagram above and must be solidly attached to the vehicle frame. (See Section 4.1.2: Plate Joints)

The "head bar" hoop must be braced from its highest point with one bar, preferably two, to a major structural member to form a tripod. If this frame is concealed within a moulded fibreglass or carbon fibre body an inspection hole must be provided.

Note: The diagrams above show secure mounting plates; teams can use other mounting approaches but it must be solid, and able to support the weight of the vehicle and rider in a rollover.

4.1.7 Leg Bar

The "leg bar" (forward bar) must protect the riders legs, knees and feet from contacting the ground in a rollover or side slide situation and must be mounted across the vehicle above the riders knee area.

The "leg bar" must be braced to prevent the bar from folding over in a rollover or sliding situation.

The protection bars (head bar & leg bar) must be able to support the weight of the vehicle and rider in a rollover (a 40km/h impact is equivalent to dropping the vehicle on its roof from a first floor landing).

NOTE: *The test for this specification is that the vehicle (with the rider in the seated position must be able to be lifted off the ground by the roll bar. This test will be applied at the discretion of the Scrutineers.*

4.1.8 Side Protection

The vehicle must have side intrusion bars (as described and illustrated in Section 4.1.1) that are an integral part of the continuous "head bar".

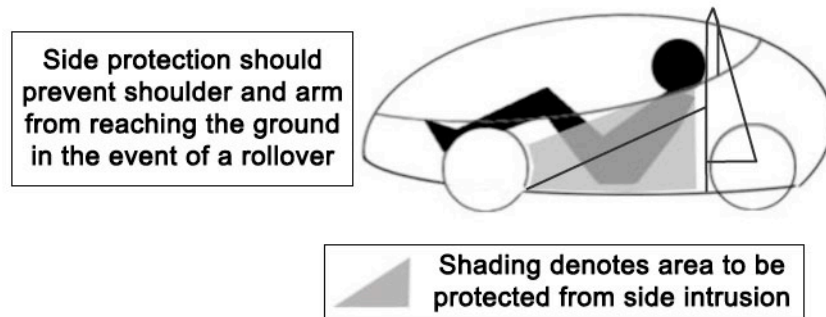
In addition to the side intrusion bars, side protection bodywork or shielding is required to protect the area between the rider's hip and shoulder from making contact with another

vehicle and to prevent the rider's shoulders and arms from reaching the ground in the event of a rollover.

This side protection bodywork should be constructed from suitably strong materials that will withstand sliding contact with the road.

No part of the rider is allowed to protrude outside the side protection during normal operation and there must be a clearance of 50mm between any part of the rider and the shielding.

SIDE IMPACT PROTECTION



4.1.9 Rider Protection Bar Clearances

With the tallest of the competing riders in the normal riding position, the “head bar” must be fully visible outside the rider silhouette when viewed from the front or rear.

A straight line from the top of one roll bar to the top of the other must have at least 50mm clearance above any part of the rider.

The head bar must conform to the following dimensions:

Measurement from helmet to inside of bar

150mm minimum

Measurement from either side of helmet to inside of bar

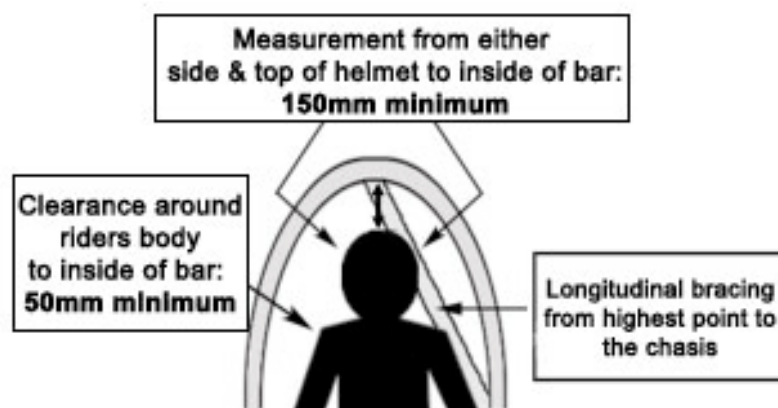
150mm minimum

Clearance around riders body to inside of bar

50mm minimum

Location forward or rearward of helmet

No more than 150mm



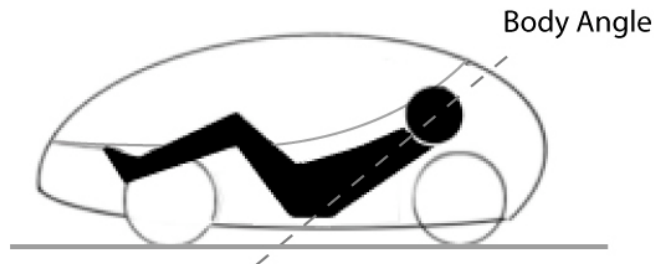
4.2 Seats

4.2.1 Position

The seat shall be fitted to ensure that the riding position does not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed.

The seat must be shaped and positioned to prevent the rider sliding under the seat belt.

In vehicles with movable seats, riders must remain fully protected by the side intrusion bars in all seat positions.



4.2.2 Locking of Seat Position

The seat must be secured and locked into position.

Adjustable seats must lock securely into position for each rider and must not move forwards or backwards. Seat belts cannot be used as part of the seat lock system.

4.2.3 Extra Padding

Any temporary or removable padding used for riders MUST be fixed into place using a positive attachment to a fixed part of the vehicle. Teams could use strap and buckle, velcro straps, dog clips, canvas zips, etc.

4.3 Seat Belt

4.3.1 Type

The vehicle must be fitted with an Approved and Certified adult Four (4) point (minimum) seat belt for all riders. Seat belts must have certification attached.

The seat belt must be completely standard, including buckle, stitching and mounting plates.

Teams will be required to demonstrate adjustment of the seatbelt to suit each rider.

Suggested suppliers:

- HEMCO INDUSTRIES, VICTORIA for price and delivery details, visit www.hemco.com.au
Wayne Fitzgerald, PO Box 444, BALLARAT VIC 3353
Ph: 03 5334 1213 Fax 03 5334 1011 hemcosb@cbl.com.au
- Klippan, Type "Street Racer" 4 point, 2 inch webbing available through Repco stores.

4.3.2 Mounting

The seat belt must be mounted to a major, non-moving, structural member of the vehicle or can be mounted to the seat provided it is suitably secured. (See Section 4.2.2)

Upper belts mounted behind the rider's shoulders are required to be no more than 40 degrees from horizontal and mounted so as not to allow the seat belt webbing to fall from the shoulders when riding.

4.3.3 Positioning

The positioning of buckles and belts on the riders body shall conform strictly to the belt wearing requirements of Australian Design Rules (ADRs) for motor vehicles.

The relevant section of the ADR 4/01 is reproduced below:

‘Seat belts are designed to bear upon the bony structure of the body, and should be worn across the chest, shoulders and low across the front of the pelvis; wearing the lap section of the belt across the abdominal area should be avoided. Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer.’

This means seat belts must:

- be worn across the chest, shoulders and low across the front of the pelvis
- be adjusted to be as firm as possible on **each** rider
- fitted to ensure that the seat belt remains properly adjusted on each rider, at all times.

4.4 Shielding

4.4.1 Spillage

Means shall be provided to prevent or contain spillage of dangerous fluids and in particular wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.

4.4.2 Driver and Passenger Protection

Chains, sprockets and gear wheels MUST be fully shielded to prevent accidental hazardous contact with rider or clothing.

Shielding or a clearance of 100mm is required between the occupant and any rotating part, such as wheels and controls, during vehicle operation.

4.4.3 Protection from Other Vehicles

Chains, gears wheels and sprockets must be suitably shielded to prevent their contact with other vehicles.

4.4.4 Shielding from Road Surface

Vehicles must be fitted with an under-tray or floor panel, which prevents occupants' feet from contacting the ground when seated in the riding position. Pedal toe clips, elastic straps or pedal-to-toe locking devices do not fulfill the requirements of this clause.

5.0 STEERING

5.1 Type

The type of steering mechanism is free, except for:

- Tilt steering and flexible steering columns are prohibited.
- A minimum clearance of at least 300mm is required between the rider's face and the steering wheel.
- The rider must have continuous positive control without the need for regular adjustment.
- Teams planning to construct vehicles with rear-wheel steering are advised to consult with the RACV and will be required to attend a Pre-Scrutineering Day.

5.2 Freedom from Binding and Fouling

Steering linkages shall operate freely from full left to full right lock without binding or fouling.

5.3 Lock Stops

Independent positive lock stops must be provided to limit the steering linkage movement at a maximum lock. **At full turning angle the steering arms will contact a [solid bracket](#) or are to be restrained by a cable/chain**, to prevent over centre travel, or contact between tyres or wheels against occupants, seats or frame components. (100 mm minimum clearance is required between the occupant and any rotating part).

(Note: A standard Greenspeed frame does not meet this requirement)

6.0 BRAKES

6.1 Independent Systems

The vehicle shall be fitted with a minimum of 2 (two) separate effective & independent braking systems. All wheels in contact with the road must have a braking capability.

6.2 Type

Single seat: At least one braking system shall operate directly on wheel hub/s or axle/s (i.e. not acting on wheel rims), and may be either drum or disc type.

Twin seat: At least two braking systems shall operate on wheel hub/s or axle/s (i.e. not acting on wheel rims), and may be either drum or disc type.

6.3 Directional Stability

Brake calipers on the same axle line (e.g. both front wheels) must operate via a single level, so that independent operation of any braking system shall not have the potential to affect directional stability of the vehicle. That is, the braking power of each and every braking system shall be symmetrical about the vehicles longitudinal centre line.

6.4 Simultaneous Operation

[The two braking systems shall be able to be operated by the rider/driver simultaneously and in Hybrid 2 a single lever may be used to operate both braking systems provided it is foot operated only.](#)

Any alternative such as motorcycle hydraulic type must be submitted for approval prior to the event.

6.5 Steering Control

Full steering control shall be maintained while any or all braking systems are being operated.

7.0 ANCILLARY DEVICES

7.1 Lighting

The vehicle shall be fitted with the following as a minimum requirement.

7.1.1 Headlights

At least one white light, with a reflector, that has the ability to project a solid beam of light (typically 1 metre wide) onto a wall at 10 metres distance. (Additional lighting to improve the rider's vision is encouraged provided at least one light meets the designated requirement).

The headlight must be positioned at the front of the vehicle and between 350mm and 600mm above the road surface.

Please note: - Sections of the track are in darkness at night and sufficient lighting to see the road will be required.

7.1.2 Tail Light

At least one red tail light, securely mounted on the vehicle, with a minimum lens area of 7 cm². Red flashing LED-type tail lights are acceptable.

7.1.3 Outline Lighting

The use of reflective material or strip lighting to indicate machine width and height (especially from the rear) is encouraged.

7.1.4 Mounting

All lights are required to be securely mounted for the duration of the event and to maintain correct aim.

7.1.5 Lighting Batteries

Additional lighting batteries may be used to power lighting and accessories provided such batteries are not utilized to assist propulsion.

7.2 Mirrors

7.2.1 Number and Type

The vehicle shall be fitted with two flat plain or mildly convex mirrors, one on either side of the driver.

7.2.2 Positioning

Each mirror shall be positioned no lower than driver chest height and such that the driver is afforded a clear view to the rear the smallest driver or smallest passenger must be able to reach and adjust each mirror from the normal riding position/s.

7.2.3 Size

Mirrors adjustable by the driver shall have a minimum reflecting surface area 40 cm².

7.2.4 Mounting

Mirrors shall be rigidly mounted to non-moving chassis or body members and be free from vibration.

7.3 Warning Device

An electric audible warning device shall be fitted (e.g. smoke alarm siren) and operate from the normal riding position. The device must not run continuously and operate via a momentary switch.

The horn must emit sound in excess of **85 dbA** measured directly in front of the vehicle at a distance of 1 metre. This will be checked at scrutineering.

7.4 Fire Extinguisher

A fire extinguisher must be fitted to all hybrid vehicles. An Australian Standard, dry powder minimum 5BE fire extinguisher of minimum capacity 0.9 kg shall be securely affixed to all hybrid vehicles in such manner and position that it can be readily reached and removed for use by either the rider from the normal riding position or external assistant in an emergency.

The location of the fire extinguisher must be clearly indicated (symbol) on the exterior of the vehicle.

7.5 Other Devices

Any other equipment, e.g. drink bottle, shall be securely mounted, and shall not impair driver control in its mounting or use.

The use of MP3's or similar music /entertainment devices by riders is NOT permitted.

7.6 Speedometer

All vehicles shall be equipped with a simple electronic speedometer (e.g. Cat eye) to monitor speed during the event (pit area speed limit of 15kph).

7.7 Engine Immobiliser

All motorised vehicles are required to fit a cut out switch that shuts down all propulsion sources and is accessible from outside the vehicle.

The cut out switch must be clearly visible (marked) and mounted on the left hand side of the vehicle and within 300 mm of the rider's left shoulder.

8.0 MARKINGS

8.1 School Name

Each vehicle shall have their school name visibly displayed on either side of their vehicle.

8.2 Identification Panels

Each vehicle shall have three white identification panels. One of each of these panels should be visible from the front and either side.

Identification panels shall be either 250 mm by 300 mm or a circle 300 mm diameter.

14. HPV and Hybrid Trial Regulations

1. SPIRIT OF THE COMPETITION

The 2009 RACV Energy Breakthrough Trial presents a unique opportunity for students to extend their learning experience beyond the boundaries of formal education. The following competition regulations have been framed so that the efforts and experiences of all participants are maximised, to be bound only by the constraints of safety and the spirit of healthy but friendly competition.

2. ELIGIBILITY

2.1 Make-up of Teams

Teams will consist of the following numbers of competitors:

- Human Powered Vehicle (6 minimum – 8 maximum)
- Hybrid Powered People Carrier – single seat (6 minimum – 8 maximum)
- Hybrid Powered People Carrier – two seat (6 minimum – 12 maximum)

2.1.1 Gender balance

Except for Open Class teams and all female team, a minimum of 50 per cent of the competitors in any one team shall be female. Gender ratio in Open Class teams is free.

PLEASE NOTE:

Teams registered in the HPV B or C class who a transfer to HPV Open will incur a 50 lap penalty in the Trial.

2.2 Registered Riders

Only registered team riders shall take part in the trial, however rider changes can be made up to the start of the endurance trial. (See Section 2.6).

2.3 Team Member Participation

Team managers must ensure that every nominated team member participates as a driver. Managers are required to keep a log of rider track time, which can be checked by officials investigating incidents.

2.4 Age of Drivers

Drivers of hybrid vehicles shall be at least 14 years of age, unless special approval is requested by the school and given by organisers.

2.5 Identification

All competitors must have official identification, which must be shown on request during the trial.

2.6 Rider Substitution

Sick or injured riders may be replaced prior to the start of the trial by a registered reserve rider of the same gender. This substitution will require the identification wristband of the replaced rider to be handed to the Administration Centre and a new identification issued to the reserve rider.

2.7 Number of Occupants per Vehicle

2.7.1 Two riders

Dual seat hybrid vehicles shall carry both driver and passenger at all times during the trial and practice sessions.

3. RIDER ATTIRE

3.1 Fit and Adjustment

All vehicle occupants shall wear the following safety attire correctly fitted and adjusted at all times the vehicle is on the track during practice and the trial.

3.1.1 Helmet

For human powered vehicles, minimum requirement is a bicycle helmet approved to AS 2063 or AS 1698.

For hybrid vehicles, requirement is a motor cycle helmet approved to AS 1698.

3.1.2 Eye Protection

Shatterproof glasses, goggles or helmet visor must be worn at all times. Provision must be made for the lights on period overnight.

3.1.3 Gloves

Strong material BMX or motor-cross type gloves preferred.

3.1.4 Shoes

Full foot coverage, sandals not permitted.

3.1.5 MP3 players

The use of MP3 players or similar music/entertainment devices by riders is NOT permitted during trial or practice sessions.

3.1.6 Clothing

For **HUMAN POWERED VEHICLES**: Minimum coverage of shoulders, upper body and mid-thigh e.g: shorts and T-shirt; or cycling knicks and jersey.

HPV Note: Sleeveless triathlon skinsuits, sleeveless cycling jerseys, sleeveless t-shirts, tank tops or singlets are not permissible.

For **HYBRID** vehicles all competitors shall wear 'OVERALLS' or clothes that cover and are neat fitting from ankle to wrist to neck. (Fire retardant material is advised in vehicles that carry raw fuel and for this reason light fabric/disposable overalls are not permitted in these vehicles).

Hybrid Note: It is not permissible for drivers of fuel powered vehicles to 'dress down' when their fuel is used up. Teams that have battery power must provide a pair of full cover gloves and a pair of protective goggles for anyone handling batteries.

4. SCRUTINEERING

4.1 Compulsory

Scrutineering is compulsory for all vehicles and teams, to ensure compliance with vehicle specifications and safety attire requirements.

4.2 Before track

Before entering onto the track for practice, all vehicles must be scrutineered for safety.

RACV Scrutineers can refuse permission to enter the track for any safety reason.

4.3 Subsequent scrutineering

Vehicles will also be inspected at random during the trial for operation of safety items or when the vehicle is involved in a track incident. (See Section 7.11)

5. TRAFFIC LIGHTS/FLAG SIGNALS

5.1 Flags

All competitors shall understand the meaning of the following traffic signals/flag signals:

Blue

Note that a faster vehicle is positioned close to you. Competitors shown the blue flag must move left (inside the blue line) to allow overtaking.

Yellow Flag or Light

A sign of danger or track obstruction in the vicinity of the marshal point.

Riders are required to pass the point of danger at a reduced speed using extreme caution. It is an offence to overtake a vehicle at the corner displaying a yellow flag or light. Riders must not resume competition until they reach the next green flag or light.

Red

An indication of extreme danger.

All vehicles shall come to an **immediate** stop. Racing has ceased. Riders must follow the directions of the Clerk of Course and flag marshals.

Black

Displayed with vehicle number at the start/finish line. **The indicated vehicle shall stop in the pits on the next lap.**

Green

The track is clear for competition.

6. START, FINISH AND BREAK

6.1 Pre-Race Briefing

All Team Managers must attend the pre-race briefing by the Clerk of Course and Trial Coordinator.

6.2 Lap Counters

It is the Team Manager's responsibility to ensure that:

- a transponder is picked up and correctly fitted to the vehicle
- the transponder is working at all times
- the transponder is returned to the Administration Centre at the end of the trial.

6.3 Grid Assembly

The Clerk of Course in conjunction with the event committee will allocate starting grid positions. Vehicles will be called to the starting grid assembly area at least 30 minutes prior to the official start. If a vehicle is not on the grid within 15 minutes of the scheduled start time, officials reserve the right to place the vehicle at the rear of the grid.

6.4 Trial Start

The trial will be started with the drop of the National flag.

6.5 Trial Finish

The trial will conclude with the display of the black and white chequered flag, 24 hours after the start for the secondary HPV and Hybrid teams and after 14 hours' of competition for the HPV Class A teams. Try-athlon teams will exit the circuit via the pit lane at the completion of their 8 hour endurance trial.

6.6 Class A Compulsory Break

6.6.1 Primary break

All HPV-A vehicles will leave the track nominally from the specified time on Friday evening and resume their trial at the specified time on Saturday.

6.6.2 Rejoining the trial

HPV-A vehicles will be assembled on the track in their finishing positions for the restart.

7. TRACK CONDUCT

7.1 Speed Limit

Speedometers are mandatory and - ALL competing vehicles shall observe a maximum speed of 60 kilometres per hour during practice and the trial, and 15 kph in pit lane.

Vehicles exceeding the speed limit (60 km per hour) during practice sessions will have a 50 lap penalty applied.

7.2 Blue Line

A blue line has been painted on the track. Vehicles must keep to the **left** of the track, on the inside of the BLUE line, unless overtaking another vehicle.

7.3 Seatbelts

All vehicle occupants shall wear a correctly adjusted seatbelt or harness when on the track during practice and the trial.

7.4 Injured Riders

Track marshals and RACV officials monitor the trial and where necessary will call for assistance from St John and the Rural Ambulance Service to attend to injured riders.

7.5 Right of Way

Competing vehicles have right of way over disabled vehicles that will be recovered and returned to the pit area.

7.6 Direction of Travel

Under no circumstances is a vehicle to be driven or pushed on the track in the opposite direction to racing.

7.7 Overtaking

Vehicles must overtake on the outside, to the right of the vehicle being overtaken. An overtaking vehicle must ensure a clearance of at least 3 metres (one vehicle length) before assuming an inside running position.

Riders must not change lanes without checking their mirrors to make sure it is safe to do so.

It is the responsibility of the overtaking (faster) vehicle to ensure that the overtaking move is carried out without endangering other competitors. Cutting in, deliberate blocking or leaving insufficient clearance will be penalised.

7.8 RACV Recovery Vehicle

When the RACV recovery vehicle is on the track it displays flashing yellow lights which indicates extreme danger in the same manner as corner yellow lights. Riders must slow, use extreme caution, must not overtake other competitors and pass when directed by the RACV driver.

7.9 Vehicle Lighting

Front and rear lights as required by vehicle specifications shall be illuminated during the hours of darkness as directed by the Clerk of Course. Riders must stop in the pits as soon as possible to rectify any inoperable or insecure light.

7.10 Lighting Batteries

Batteries used solely for lighting may be charged and/or recharged and/or replaced as required.

7.11 Track Incidents

Vehicles involved in major on track collisions, crashes or rollovers must be tagged by officials and are required to proceed directly to the pits for inspection and if necessary, repair. It is the responsibility of the rider and the team to ensure a crashed vehicle is tagged and any deliberate attempt to avoid tagging will incur a penalty. Tagged vehicles will not be allowed to rejoin the trial until the tag is removed following an RACV inspection.

Vehicles will also be inspected at random during the trial for operation of safety items such as brakes or mirrors which will also require rectification before continuing.

8. PIT PROCEDURE

8.1 Speed in Pits

Maximum speed in the pit area is 15 km/h.

8.2 Direction of Travel in Pits

Under no circumstances shall a vehicle enter the pit area via the pit exit lane.

8.3 Driver Change-Over

All driver and passenger changes shall occur in the designated area adjacent to each team's pit.

8.4 Stopping in Pits

8.4.1 Brakes only

Vehicles shall come to a halt in the driver change lane under the effect of the vehicle's own braking system. Stopping with the assistance of others is not permitted.

8.4.2 Full stop

Vehicles shall be stationary prior to unfastening seatbelts or harness.

8.4.3 Riders/Drivers

Driver refreshments and adjustments to clothing etc. shall only be effected when the vehicle is stationary in the pit area.

8.4.4 Pit Crew

A maximum of three students and one supervising adult, in addition to the incoming and outgoing riders, shall attend a vehicle in the pit lane at driver change-over. The four designated people from each team attending the vehicle in pit lane are encouraged to wear a green reflective vest.

8.5 Pit Lanes

Pit entry and exit lanes shall be kept clear at all times.

8.6 Pit Crew Communications

[The use of radio communication between rider and pit crew is permitted provided operating the unit does not interfere with the rider's control of the vehicle.](#)

The use of notice boards for communication between the rider and the pit crew are permitted. However, such notice boards and their use shall comply with the following:

- they must be held and displayed by one person only at a time
- they must be held so they do not go beyond the line of pit lane barriers.

8.7 Major Repairs

Major repairs shall NOT be carried out in pit lane. Teams may not substitute or replace power sources or strip the vehicle below its starting weight after the commencement of the event.

8.8 Stationary Vehicles

In pit or driver change lanes, stationary vehicles shall give way to vehicles proceeding along these lanes.

8. Removal of Components

Redundant, superfluous and/or damaged components of substantial mass i.e. greater than 0.5 kg, may not be removed from a vehicle except with the permission of the chief scrutineer or deputy. At the discretion of the Chief Scrutineer his/her deputy, the vehicle may be required to carry ballast.

8.10 Vehicle Restarts

Vehicles that have been involved in a track incident and received a coloured sticker CANNOT restart until a RACV Marshal has checked the vehicle and removed the sticker.

9. FUEL USE AND RECHARGING OF BATTERIES

9.1 Fuel Burning Hybrid Entries

In accordance with Section 1.4.2 of the Hybrid specifications, fuel burning hybrid entries will receive a single allocation of fuel. This allocation may be split and used to directly power the vehicle and for recharging of batteries, either on or off the vehicle.

9.2 Amounts of Fuel Allocated

Are as follows:

- Single seat hybrid **3 litres**
- Dual seat hybrid **4.5 litres**

9.3 Sealing of Fuel Tanks

Fuel tanks on vehicles or on off-vehicle charging machines will be sealed after the allocation of fuel prior to the start of the event.

9.4 Batteries

At scrutineering, teams using batteries are required to present all of their battery allocation for identification marking. All batteries must have manufacturers labels including details of battery type displayed.

9.5 Recharging

Recharging of propulsion batteries shall only be carried out in a clear, accessible and ventilated area, and by means other than connecting to mains power. Pedal based generators are recommended. **NOTE:** Only designated riders may participate in pedal based recharging.

Wind generators and associated structures are NOT permitted due to on site safety implications.

10. TRIAL POINT SCORING

The vehicle completing the most number of laps in each class in the trial period scores the maximum 50 points. Other vehicles in each class score points for the number of laps completed in proportion to the number of laps.

For example, say team AA in a particular class travels the greatest distance, 200 laps, and team BB in the same class travels 160 laps. Points scored are as follows:

Team AA:

200 laps = 50 points

Team BB:

160 laps $50 \times \frac{160}{200} = 40$ points

11. INFRINGEMENTS

11.1 Vehicle Design

Vehicles which are considered safe but DO NOT comply with key elements of vehicle specifications may be given permission to start the trial with a penalty. This penalty can be up to 50 laps and will be applied by the RACV Scrutineers.

11.2 Reporting of Incidents

Teams may report track incidents or infringements of these competition rules to the RACV officials who will investigate and act accordingly. If teams wish to proceed with an official complaint they will be provided the appropriate documentation.

11.3 Penalties

A team that breaches any trial regulation will be notified that they are under investigation for an infringement of the competition rules. A panel of officials will review the incident and apply a penalty which they consider is consistent with the severity and intent of the infringement. An incident review should be conducted within 30 minutes, but in any case will be resolved before the end of the trial.

Penalties may take the form of:

- A warning
- A stop and go penalty
- [A time penalty](#)
- 50 lap penalty
- Disqualification of a rider
- Exclusion from trial results; or
- Withdrawal from competition.

Powercor TRY-ATHLON Rules and Guidelines



The Try-athlon category was created in 2001 for first time teams who wanted a taste of the Energy Breakthrough. Since its creation the category has quickly grown in popularity and competitiveness.

Teams participate in the Display & Presentation and Design & Construction sections, but also in three physical tests – creating the most widely assessed category at the Breakthrough.

Teams should note that all the existing rules and guidelines, as outlined in this Handbook will apply. This includes:

- **HPV Vehicle design and specifications – begins on page 41**
- **Team composition and Classes – see page 11**
- **Camping – see page 10**
- **Judging of Display & Presentation; and Design & Construction – see page 15.**

The number of Classes conducted is subject to change based on demand.

Class A Teams comprising primary students only, in which at least half of the team members are female.

Class B & C Teams comprising secondary students only, in which at least half of the team members are female.

Open Class Teams that cannot fulfill the above requirements for the number of females in the team.

Assessment

Section	Points
Display & Presentation	20
Design & Construction	20
Time trial	15
Obstacle	15
Endurance Trial	30
Total	100

Event 1: Time Trial

Venue: RACV Track (Near Marshall Point 5)

Circuit Length: Approx. 500 metres per lap

Event Format: Two Rounds of heats – 1st Round: riders 1-4; 2nd Round: riders 5-8.

All 1st Round heats will be completed before the commencement of the 2nd Round. There will be three or four teams per heat, typically from the same class.

Riders will each complete one lap of the Time Trial circuit before changing over in the allocated pit areas under the direction of the track marshals.

Points Allocation for Time Trial

Points will be allocated on the total team time recorded.

That is, 15 points to the team recording the fastest time.

Scoring: $\frac{X}{Y}$ multiplied by 15 = Time Trial Score

Where Y = fastest team time recorded & X = teams own time

Event 2: Obstacle Rally

Venue: RACV Track (Near RACV Stage)

Circuit Length: Approx. 500 metres per lap

Event Format: One round – Riders 1 – 8.

Each team will complete the Obstacle Rally which will incorporate several stations or control challenges. Riders will each complete one lap of the Obstacle Rally circuit before changing over in the allocated pit areas under the direction of the track marshals.

Points Allocation for Obstacle Rally

Scoring: $\frac{X}{Y}$ multiplied by 15 = Obstacle Rally Score minus penalties.

Obstacle Rally – Penalties & Infringements:

Infringement	Penalty Points
Contact with hay bale or barrier, loose seat belt and/or helmet,	0.2
Careless driving, contact with other vehicle, no seat belt, no helmet, incorrect pit change over	0.5
Very dangerous driving	1

Event 3: Endurance Trial

Venue: Holden Track

Circuit Length: Approximately 1100 metres per lap

Duration: 8 hours

Teams will compete over eight hour and each rider should complete at least 30 minutes riding. Try-athlon teams complete the Endurance Trial during the first 8 hours of the Hybrid trial.

Teams assemble as directed and the trial will commence with a rolling start behind the RACV vehicle.

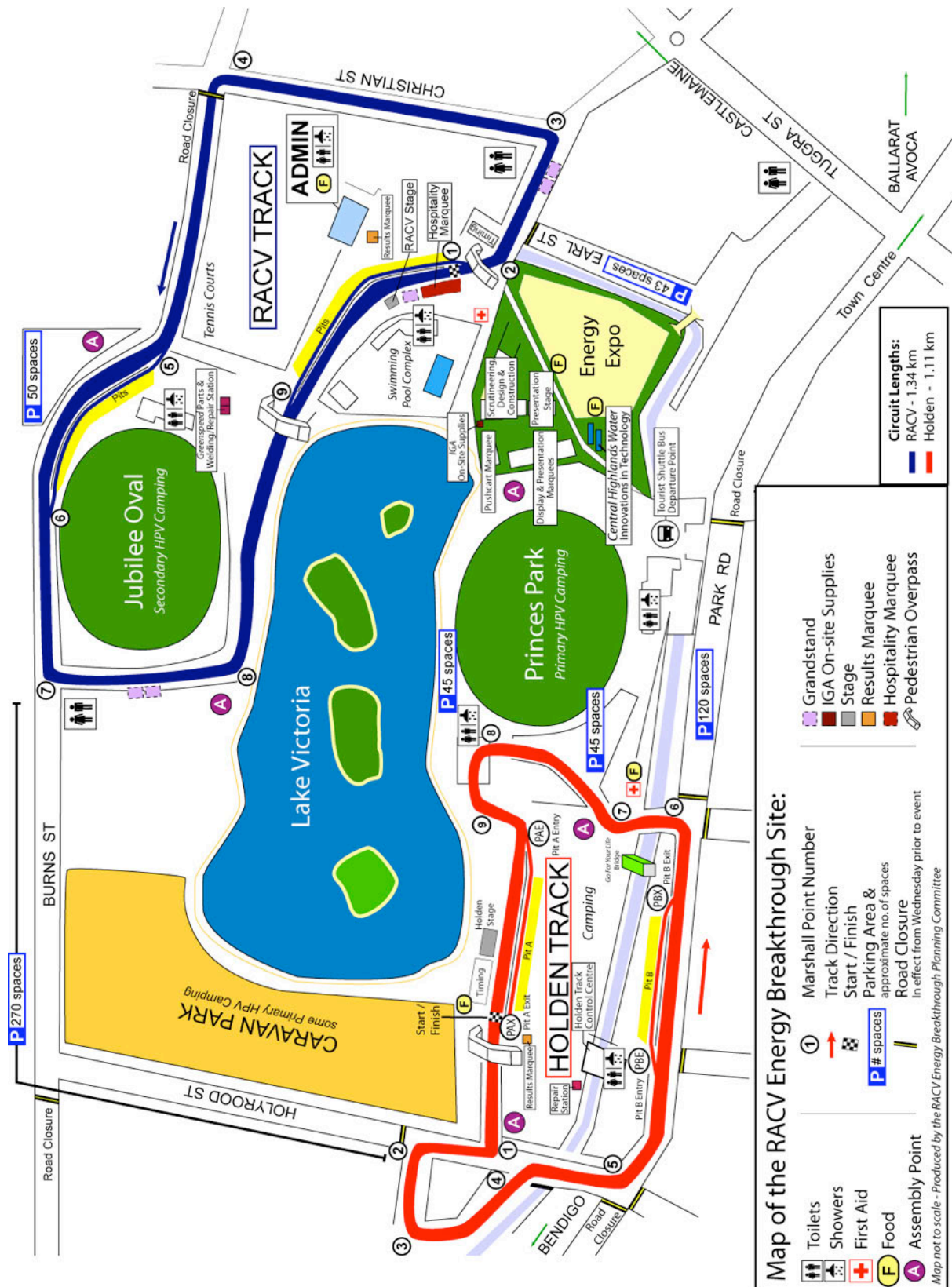
Points Allocation - Endurance Trial

Points will be allocated on distance completed by the team. That is, 30 points to the team recording most laps.

Other finishers: (X/Y) 30 = points

Where Y = highest number of laps recorded & X = teams number of laps.

Endurance Trial Penalties & Infringements – See HPV & Hybrid Trial Regulations – page 59.



•• P L E A S E ••

•• Before completing the entry form ••

- Ensure that you have read this Handbook carefully
- Use a separate entry form for each team entry
- Forward form/s and payment to:

**THE 2010 RACV ENERGY BREAKTHROUGH
PO BOX 194
MARYBOROUGH, VICTORIA, 3465.**

NB: No refunds, except for teams on a waiting list that are not offered a place.

CLOSING DATE FOR ENTRIES

Friday 7th May 2010

FOR

**HUMAN POWERED VEHICLES,
TRY-ATHLON & HYBRIDS**

Friday 25th June 2010

(Last day Term Two)

FOR

PUSHCARTS

and

INNOVATIONS IN TECHNOLOGY

2010

March

May

June

October

November

Timeline

Entry forms available from the event website from March 9, 2010.

Friday 7th May 2010

Closing Date for Entries in

**HUMAN POWERED VEHICLES,
TRY-ATHLON & HYBRID VEHICLES**

**Friday 25th June 2010
(Last day Term Two)**

Closing Date for Entries in

**PUSHCARTS
And
INNOVATIONS IN TECHNOLOGY**

**Camping requirements confirmed with
RACV Energy Breakthrough office**

**Early November
Information Kit Released**

**18th – 21st
THE BIG WEEK-END!**